The Quarterly

Vol. 4 January, 1911 No. 3

Our New Responsibilities. Our active member, the National Board of Fire Underwriters, has recently put forward a plan of unification and consolidation in respect to its fire prevention engineering activities that will be of striking interest to our members as indicating a very considerable addition to our work. It has requested us to make suitable preparation to take over the work of the two heretofore unaffiliated bodies, the Underwriters' National Electric Association and the Committee of Consulting Engineers of the National Board. The National Board officials have long felt the desirability of unifying the sources from which that body has for so many years drawn its various codes and standards. The National Fire Protection Association has furnished standards for all protective devices and systems; the Consulting Engineers have handled the hazards of gases and oils, and the Underwriters' National Electric Association has been responsible for the National Electrical Code. These three standard-making bodies are now to be merged into one; the National Fire Protection Association, and the work of the two latter bodies, which will cease to exist as detached organizations, will be conducted by special committees of the National Fire Protection Association. The Underwriters' National Electric Association will be entitled the Electrical Committee, and the Consulting Engineers will be called the Committee on Explosives and Combustibles, of the National Fire Protection Association. The personnel of the new committees will be identical with that of the two former separate bodies, with the addition to each of one or two desirable members. Thus the National Board will not lose the benefit of the counsel of the men who have so long rendered exceptionally valuable service in the two bodies, and the National Fire Protection Association will gain in influence and dignity by this striking addition to its responsibilities and such manifestation of confidence on the part of its distinguished active member, the National Board.

The importance of this work soon to be taken over by our Association will not need to be emphasized to those who have been familiar with the functions of the two bodies to be merged in it. Since the first recognition of the fact that there was a fire hazard in connection with the use of electricity for light or power, the Underwriters' National Electric Association has had the responsibility of locating and interpreting this hazard.

The National Electrical Code is not only the free-born child of this Association, but a child which, during the long period of years in which the uses of electricity have so phenomenally developed, has been reared with such unselfish devotion as to command the respect and commendation of the vast interests affected by it. The only code in existence covering the safeguarding of electrical equipments, it has been adopted as the law of more municipalities, and is the standard of a greater number of other organizations with authority, than any other single set of engineering specifications in existence.

To the Consulting Engineers, also a body of many years service, has fallen the important task of compiling standard specifications for the protection of property from hazards not electrical. The work of this body is manifested in the rules and specifications already in effect on films for motion-picture machines; systems for storing hazardous fluids; acetylene gas machines; gasolene vapor gas lighting machines, lamps and systems, engines and stoves; rules for waste cans, ash cans, refuse barrels and safety cans for benzine, storage and use of fuel oil, and kerosene oil pressure systems.

In response to the request of the National Board that we prepare to meet our new responsibilities, the suggested committees were appointed by the Executive Committee at its meeting in New York City November 18, 1910.

Following is the membership of the

ELECTRICAL COMMITTEE.

F. E. Cabot, Boston, Secretary Boston Board of Fire Underwriters, Chairman.
Ralph Sweetland, Boston, Engineer New England Insurance Exchange, Secretary.
William S. Boyd, Chicago, Electrical Inspector The Union.
George E. Bruen, New York, Superintendent Electrical Inspection Department, National Board of Fire Underwriters.
J. E. Cole, Boston, President National Association of Electrical Inspectors.
Washington Devereux, Philadelphia, Inspector Philadelphia Fire Insurance Association.
J. C. Forsyth, New York, Electrical Inspector New York Board of Fire Underwriters.
C. M. Goddard, Boston, Secretary New England Insurance Exchange.
C. H. Hill, Philadelphia, Electrical Inspector Underwriters' Association of the Middle Department.
H. O. Lacount, Boston, Engineer Factory Mutual Insurance Companies.
Charles Lum, New York, Engineer National Board of Fire Underwriters.
A. M. Paddon, Syracuse, Engineer Underwriters' Association of New York State.
Dana Pierce, Chicago, Electrical Engineer Underwriters' Laboratories, Inc.

A. M. Schoen, Atlanta, Engineer South Eastern Underwriters' Association.
R. P. Strong, New Orleans, Chief Electrical Inspector Louisiana Fire Prevention Bureau.
V. H. Tousley, Chicago, President Western Association of Electrical Inspectors.
Farley Osgood, Newark, N. J., Representing American Institute of Electrical Engineers.
E. McCleary, Detroit, Mich., Representing National Electrical Contractors' Association.
W. H. Blood, Jr., Boston, Representing National Electric Light Association.
Also one member as representative of the American Electric Railway Association.

Following is the membership of the

COMMITTEE ON EXPLOSIVES AND COMBUSTIBLES.

Charles A. Hexamer, Philadelphia, Secretary Philadelphia Fire Underwriters' Association, Chairman.
E. J. Smith, Chicago, Engineer Underwriters' Laboratories, Inc., Secretary.
George E. Bruen, New York, Engineer Electrical Inspection Department, National Board of Fire Underwriters.
F. E. Cabot, Boston, Secretary Boston Board of Fire Underwriters.
F. M. Griswold, New York, General Inspector Home Insurance Company.
H. C. Henley, St. Louis, Chief Inspector St. Louis Fire Prevention Bureau.
W. D. Matthews, Chicago, Chief Surveyor Chicago Board of Fire Underwriters.
A. M. Schoen, Atlanta, Engineer South Eastern Underwriters' Association.
F. J. T. Stewart, New York, Superintendent of Surveys New York Board of Fire Underwriters.
Alfred Stillman, San Francisco, Secretary Board of Fire Underwriters of the Pacific.
Ralph Sweetland, Boston, Engineer New England Insurance Exchange.
A. G. Wilbor, Hartford, Inspector Factory Insurance Association.
Louis Wiederhold, Jr., Philadelphia, Secretary Underwriters' Association of the Middle Department.

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Another New Committee. At the last annual meeting a motion was adopted that the Executive Committee take under consideration the appointment of a committee on subjects relating to electric railway and power properties outside of their electrical equipment. In response to the same the Executive Committee has appointed the following:—

COMMITTEE ON ELECTRIC RAILWAY, LIGHT & POWER PROPERTIES.

C. H. Patton, Chairman, Park Building, Cleveland, O., R. C. Bird (F. U. E. B.), G. E. Bruen, J. C. Forsyth, F. W. Jenness, M. F. Jones (N. E. B. of U. I.), J. V. Parker, H. N. Staats, R. Sweetland, A. M. Schoen, W. S. Wensley, L. Wiederhold, Jr., A. G. Wilbor, Representative A. E. Railway Association.

It will be noted that this committee is practically the old Committee on Car Houses which was disbanded in 1908 after the completion of three years very important work in the preparation of a standard for these properties covering construction and automatic sprinkler protection. This standard was unanimously adopted by the American Street and Interurban Railway Association at its convention in Atlantic City in October, 1907.

Devices and Materials Committee Meeting. Two important matters were considered by the Devices and Materials Committee at its October meeting in New York, in addition to the usual volume of routine business. After a discussion relative to the consideration which should be given to devices other than those covered by the present standards of the Association, the following resolution was adopted:—

> It is the sense of the meeting that devices submitted, which cannot be approved because they cannot be examined under any existing standard, should be considered on their merits and opinions on the same regularly promulgated, and if in the opinion of the Committee there exists a necessity for the preparation of standards to cover such devices, the attention of the Executive Committee shall be called to the fact.

The matter of window and door openings was taken up and it was voted that the attention of the Committee on Fire Protection Coverings for Window and Door Openings be called to the apparent discrepancy between the different classes of the rules covering Fire Windows.

Following discussion on the necessity for exercising some control over the methods of construction employed in fire windows and fire doors of sizes in excess of those for which the present standard requirements are drawn, it was voted as the sense of the committee that specifications be drawn for "oversized" windows and doors, and that the attention of the Executive Committee and the Committee on Fire Protection Coverings for Window and Door Openings be called to this action and the co-operation of these committees invited.

The importance of securing action in this matter before the next annual meeting by concurrent action of the three committees referred to was emphasized in the remarks of a number of the members.

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Signaling Committee on Lightning Protection. Following a considerable correspondence of the Secretary's office with the manufacturers of lightning rods, the Executive Committee asked the Committee on Signaling Systems for an opinion as to the expediency of re-opening the discussion on rules for the installation of such devices. After a consideration of the matter and a review of the correspondence by the Committee at its meeting in Boston on October 26th, Chairman Sweetland advised that it was the opinion of the committee that nothing had been brought to its attention which would warrant recommendation for changes in the published suggestions of the National Board of Fire Underwriters for Protection against Lightning.

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Fire Waste of 1910. The shame and scandal of a fire-waste $30,000,000 in excess of that of 1909, and a succession of holocausts in December that appalled the imagination, leave us with the disconcert-

ing impression that another decade may pass before we shall be able to reduce the size of our colossal annual ash heap. Certain facts which cannot be evaded call for devout consideration. One of these facts is that, notwithstanding the effectual work that is being done for the conservation of property, the average fire loss ratio to the value of the property exposed is not diminishing. The fire losses of the United States and Canada, during the year ending with November, 1910, amounted to $232,918,000, as compared with $198,303,000 for the preceding year, that being an increase over the next year preceding of $34,615,000. The depreciation in burning ratio, resulting from improved building construction, growing effectiveness in inspections, testing of devices, the installation of high pressure water systems, improvements in fire departments and fire fighting appliances, and the like, are being counteracted by the steady aggregation of congested values, climatic changes due to the denudation of the forest area, and the never-failing negligence with which we seem to be cursed above all other peoples.

There seem to be at times such cumulative demonstrations of our collective irresponsibility as to induce the thought that some cosmic influence occasionally precipitates a succession of horrors to reveal us to ourselves. Such a revelation came with the decline of the year just closed. The horror of Newark might have been prevented. The explosion in the New York Central power house was unnecessary: anyone with a nose can detect the presence of Pintsch gas. The lamentable loss of life at the Stock Yards fire in Chicago December 22nd, and in Philadelphia a few hours earlier, and the loss of life and property in Cincinnati the day before,—all these are characteristic of America and brand us with our collective guilt.

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Forest Fire Conference. The recent forest fire conference at St. Paul will, it is believed, lead to great improvements in the protection of the forests against fire, and will consequently reduce the fires in lumber properties and towns exposed heretofore to the forest fire hazard. This year's insurance losses included $2,000,000 on two forest fires alone, those at Beaudette and Spooner, Minn., and at Wallace, Idaho. The conference was made up of lumber men, railroad men, state foresters and state officials, H. N. Kelsey, chairman of the committee on publicity and education of the Union, representing the underwriting fraternity. It was conclusively shown that much could be done to reduce the forest fire hazard if the forestry service now in successful operation in several states were adopted generally. Resolutions were adopted recommending that the forest fire protection of each state be placed under the control of a non-partisan commission, that an adequate forest patrol system be established, co-operating with the national government, that the burning of debris on the rights of way of the various railroads be under the control of the state forestry patrol, that fire lines be formed

around exposed property, and that there be strict regulation of the burning of bushes and debris in clearing land during the dry season. Telephone and telegraph lines, trails and other means of communication in country subject to forest fires were recommended, with at least one forestry patrolman for every 40,000 acres requiring protection.

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Mutual Fire Prevention Bureau. In a desire to reduce the fire hazard and fire waste in connection with mill and elevator properties, the officers of eight Mutual fire insurance companies writing policies on these classes of property have organized the Mutual Fire Prevention Bureau, with headquarters at Oxford, Michigan, and Mr. Wm. Reed as secretary. This organization is to have nothing to do with underwriting or rating, but as its name implies is to devote itself to consideration of the structural and mechanical problems connected with milling and with working out plans for the fire protection of such properties. Considering the heavy losses in mills and elevators, this is an admirable move on the part of those interested. The new bureau expects to be able to serve not only the underwriting interests, but to do a much needed educational work among individual millers, grain dealers, and all others affected by the fire waste of mills and elevators.

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Fire Protection Engineering. The committee on Fire Protection Engineering of the alumni association of the Massachusetts Institute of Technology, which committee is composed of our valued members Gorham Dana of Boston and John R. Freeman of Providence, together with Prof. Charles L. Norton of the Institute, has made an interesting report on the need of a course or partial course in Fire Protection Engineering at that institution. Pointing out the enormous proportions of the fire waste and the public responsibility therefor, the report says:—

> During the past twenty or thirty years many steps have been taken to improve conditions, but the march of progress is still far too slow. The National Board of Fire Underwriters, the National Fire Protection Association, the Factory Mutual Insurance Companies, and other insurance organizations, have done excellent work in pointing out present defects and in urging better construction and improved protection. Improvement in this line is largely a matter of education, therefore it seems particularly appropriate to extend the movement to schools and colleges. In Ohio a law has recently been passed requiring at least thirty minutes a month instruction in primary and grammar schools on the Dangers and Chemistry of Fires. The Armour Institute of Technology at Chicago devotes an entire course to the subject of fire protection engineering. The Stevens Institute of Technology, Harvard University, and certain other colleges, are giving courses of lectures on the subject.
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> It appears so plain as to require no argument that every engineer should be given at least elementary instruction in this subject, and even more important that students in architecture and mill engineering should devote some time to it.
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> It is estimated that there are over seven hundred persons in the country to-day, in boards, bureaus and individual companies, engaged in this branch of engineering;

and of these about forty-five are M. I. T. graduates. A considerable number of the others have been special students at this institution. The call for new men in this field is perhaps seventy-five to one hundred a year. The Armour Institute, which is believed to be the only college in the country giving a complete course in the subject, is turning out five or six men a year, and it is said cannot supply the demand. There is considerable demand for laboratory and research work along fire protection lines. At present, outside of the Underwriters' Laboratories in Chicago, the Factory Mutual Laboratories in Boston, and other insurance laboratories, together with the New York City and the United States Government Laboratories for testing building materials, there are few suitable places for carrying on such work. The Massachusetts Institute of Technology seems plainly to be a logical place for such investigations, and your committee believes that the subject is of sufficient importance to warrant more consideration here.

Your committee therefore recommends:—

(a) That the subject of Fire Protection Engineering be treated in as great detail as may be found practicable in a course of lectures, open to all engineering courses.

(b) That as soon as financial conditions warrant, the subject be offered as an option in some existing courses, possibly that of chemical engineering, in the form of lectures with laboratory work.

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British Fire Prevention Committee. We have advices from the British Fire Prevention Committee that it is to undertake a campaign of popular propaganda similar to that being conducted by our Association. The letter from the chairman of the Executive says:—

We, too, feel that we should extend our work outside the limits of our own membership, and try to popularize the important subject of fire prevention, instead of keeping solely to the scientific aspects.

The chairman extends an invitation to any member of the N. F. P. A. to join the British organization without payment of entrance fee, the annual dues being the same as in our own organization. Members who may be interested should address British Fire Prevention Committee, 8 Waterloo Place, Pall Mall, London, S. W.

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Tin-Clad Fire Shutters. In response to an inquiry from our department of fire record regarding a fire in Lynn, Mass., our valued member Mr. S. Oliver Breed, sends us a most interesting report. It is not ordinarily the complaint of fire appliances or retardants that they do their work too well; but the shutters in the property in question were in Mr. Breed's opinion responsible for an increased damage. Following is the report:—

The P. B. Sherry building was a six-story brick structure with a driveway in front and area in the rear between the two sections. There were two elevators without traps and the doors were usually left open. There were cross partitions which obstructed light appearing. In the front, or Munroe Street side, the windows were shuttered on the inside with tin clad shutters fitting very closely and were well cared for. Very seldom have I seen one left open.

The fire is supposed to have started on the second floor in the rear. The shutters being all closed, and the partition intervening, the fire was not discovered until the whole building above the second story was thoroughly on fire, the flames pouring from the third-story front windows when the firemen reached the building. The fire was discovered by a night policeman on Oxford Street, in the rear of the building.

The adjoining buildings were so close on the Munroe Street side as to almost touch the walls of this building, but the inside shutters prevented the flame from doing them much damage. The lesson of this fire to me is that shutters prevent the spread of fire from a building and prevent a fire from entering a building, but also prevent a fire from being seen from the outside in time to save the property.

This is the third time within two years that we have had it shown to us here. In the Ashcroft building a barrel of waste took fire, located almost directly under a sprinkler and thermostat. The shutters on that side of the building, there being a large area, were not required to be closed, the light was seen by an outsider and an alarm pulled in, the firemen being only six hundred feet away got there just as the automatic fire alarm sounded and extinguished the fire before the sprinkler fused.

The sprinkler and thermostat were within two feet of each other. Within four feet of the sprinkler there was some two to three thousand dollars worth of shoe upper stock which would have been utterly ruined had the sprinkler started, which would certainly have happened had the alarm been delayed even one minute. The other fire happened under similar conditions.

Windows of wired glass would afford protection and not prevent the fire from being seen.

The point made by Mr. Breed is worth consideration. We understand that some of the buildings in the recent large fire in Cincinnati might have been saved had it been possible to close the shutters. Although metal window frames and wired glass may not in severe exposures have the fire-resisting quality of standard fire shutters, they are always in service, which is decidedly an advantage, and they do not shut out the light.

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A Physician on Wired Glass. As the result of the explosion in December in the New York Central plant in New York City, the window glass was shattered in all directions, the principal minor personal injuries being due to broken glass. In the bottling department of the Schaefer Brewing Company, nearly opposite the New York Central power house, all the ordinary glass windows were blown out, some of them with their frames also. The lower floor was equipped with metal window frames and wired glass, and none of the latter was wrecked. One light in the door was severely shattered but held all its glass intact.

Commenting on this circumstance, Dr. Royal S. Copeland, Dean of the New York Homeopathic Medical College and Flower Hospital, whose surgical skill was in demand after the explosion had occurred, said:—

I believe that every public vehicle should have glass of this pattern, or glass protected by wire netting. I operated on Monday from nine o'clock in the morning until four o'clock in the afternoon and a good many hours since that day. Most of my work consisted of picking fragments of broken glass from human flesh and repairing damages resulting from broken glass. I removed an eye from one

poor victim and another lost both eyes. Several suffered minor injuries of the eye, but all of them had serious scalp and face wounds due to the same cause.

I am determined to do what I can to educate the profession and the public of the importance of this subject. I saw eighteen or twenty cases from this accident; within six months I had two young women as patients who were riding in a taxicab, which collided with a street car. The front window of the cab broke and these women were injured by the shattered glass. Two years ago I saw fifteen or twenty people injured in a street car accident and practically everyone of these had injuries of the eyes and of the body caused by broken glass.

I would like to know about the comparative cost of this reinforced glass with common glass. I would like to be furnished with comparisons of weight, etc.

The United States census reports show that the largest factor in "the causes of death" is death by accident. I think it is time that the public came to appreciate this fact and anything which will eliminate possible causes of death and injury should be insisted upon.

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A Kitchen Stove Hazard. A number of manufacturers of kitchen ranges are advertising to provide a range from which it is unnecessary to remove the ashes by means of the ordinary pan. A funnel is provided underneath the grate of the range, this funnel or pipe extending through the floor and into a receptacle in the basement.

Common sense would seem to demand that this pipe should be insulated by a protecting sleeve which will afford an air space between the funnel itself and the floor through which it passes. The passage of the ashes should normally entail no hazard. The hazard would seem to lie in the possibilities of clogging, or of the funnel filling up to the level of the floor from neglect in emptying the receptacle in the basement. It would seem that the responsibility of making these equipments safe should properly rest upon the manufacturers. The receptacle itself in the basement should be of standard character and rigidly installed. An improvised receptacle might be very hazardous. To drop hot ashes out of sight into a basement does not have a reassuring sound to those who know already the hazards of ordinary handling of ashes.

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The Fire Record. The fire record of Bleach, Dye, Print and Finishing Works contained in this issue is an unusually interesting compilation. Of the total number of 286 fires in such properties, the lighting and power factors contribute their quota as usual. It is the fires due to the special hazard causes that throw such an illuminating light upon the risks of the processes carried on. The processes of singeing, dye-mixing, printing, steaming and ageing, drying and napping, all are shown to require special safeguarding, and the liability of freshly dyed goods to spontaneous ignition is sufficiently exemplified by the twenty-three fires reported due to that cause.

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Christmas Holiday Fires. Our special record of Christmas Holiday fires given in this issue is, as the foreword indicates, a hasty gleaning of those cities in which our correspondents can obtain

and promptly forward such data. Such fires occur principally in dwellings, and we have no means of securing reports thereon except in certain metropolitan districts. No data can be had from the vast territory of the United States containing the innumerable small cities and towns, although these are the districts in which knowledge of the fire hazard is most backward, and hence, inferentially, the districts in which most of such fires occur, with their often-accompanied casualties.

Although but one fire shows property losses of any considerable magnitude, a number of them record the fatal burning of children, and it is believed that if statistics covering the entire country were available, they would indicate that the sacrifice of child life to the fire god at Christmas time is enough to warrant the banishment of the Christmas candle altogether.

Over fifty fires are reported in this record. It is safe to say these represent about ten per cent of the total for the country; and this, if correct, would mean 500 fires from this cause during the late holidays.

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The Christmas Bulletin. In the light of the above facts and the conclusions which may be drawn from them the value of a wide distribution of the **Christmas Bulletin** issued by the Association is apparent. This season's very effective bulletin was prepared by the Committee on Common Causes of Fire, and would have had a very wide distribution among the constituents of our active members, had sufficient time been afforded for such distribution. The delay in the delivery of the illustrations, which required to be especially prepared, made the mailing time too short for proper delivery through the mailing systems, and yet despite the shortness of time some half dozen of our active members ordered copies in quantities and distributed the same. The National Association of Credit Men distributed 2,000 copies, keeping up its reputation for lively co-operation.

We shall hope to make a more effective weapon of this bulletin next season.

The Publicity Campaign.

President W. H. Merrill has made the principal donation of time and energy to the work of the publicity campaign during the current quarter. As this issue of the Quarterly goes to press he is homeward bound from a special trip to the Pacific coast, where he spoke on January 11th at the thirty-fifth annual meeting of the Fire Underwriters of the Pacific. Members will recognize the value of this unusually arduous service on the part of the President. In order that this first presentation of our work in the extreme West should be cumulatively effective, our exceedingly valuable active member, the National Association of Credit Men, arranged two additional meetings for President Merrill on the coast. On January 13th the San Francisco Credit Men were the hosts; on January 16th in Los Angeles, the Merchants and Manufacturers Association was the entertaining body. The plea for the consideration of our work could not have been presented under more favorable auspices; and with the ability and fine enthusiasm of Mr. Merrill as the vehicle, the favorable effect of our first attack upon the far West cannot well be over-rated. In his speech before the underwriters at San Francisco on January 11th,—which we are having printed in pamphlet form for distribution to members,—Mr. Merrill referred ironically to the virtues of dry-powder fire extinguishers. He said:—

"Seven years ago a man put ten cents worth of baking soda in a five-cent tin tube. He sold it for three dollars as a fire extinguisher to use in the stage chamber of the Iroquois Theatre in Chicago. At a Christmas pantomime this great chamber was hung with flimsy draperies representing fairyland. One of these draperies was ignited by a spark from an electric lamp representing a moon. The operator testified that the fire in its incipiency could have easily been extinguished by a small stream of water, but the unreal extinguisher being at hand, he waved it as directed, expecting the magic wand to be effective in such surroundings. Unfortunately, there was nothing 'make-believe' about the fire, and the result was and always will be very real to the families and the friends of over six hundred women and children, whose lives were sacrificed that a man might make a profit of two dollars. I have not heard that the taker was punished. One of his confreres offering the same line of goods recently received the endorsement of a leading official of a great state, who in lessons he had prepared for the instruction of school children and until their limitations were called to his attention, recommended these appliances as suitable for general use.

"Of course, there must be some talking point and an item of reality in connection with all such appliances. The so-called dry powder fire extinguisher will quickly and dramatically subdue a small quantity of gasolene burning in a cuspidor, and it will act similarly with certain other small fires in confined spaces. The point is, we do not have many gasolene fires in cuspidors; we cannot educate our fires to meet the limitations of the specialty extinguisher."

He also touched upon the present character of much of the rubber-covered wire sold for use as electrical conductors, and paid his respects to the fire hose situation:—

"Certain brands of so-called rubber-covered wire, conducting that subtle form of energy, electricity, through the concealed spaces of our houses are sold for about the price of the copper they contain. If any real rubber is used in their coverings the fact has escaped the observation of a number of enlightened investigators.

"In fire hose, the arteries and veins of our fire departments, we find manufacturers making a monstrous mystery of their wares, analysts proving them rotten or unfit for use, and gossips busy with tales of scandal about the reasons why inferior hose is delivered when superior is supposed to be paid for from the public treasuries."

The speaker had, however, many words of praise for the hosts of manufacturers of other materials and devices who are co-operating with us in the production of honest and effective wares, and many of whom are able to put out their appliances carrying the labels of the Laboratories' inspection service as a voucher to the public:—

"Real fire windows, real fire doors and shutters, and various excellent forms of building materials are being installed; fire extinguishing appliances with their fittings and appurtenances are being constructed in accordance with recognized standards; electrical fittings of all kinds are being properly safeguarded, and the hazards of many gas and oil using devices are being reduced to a minimum."

Mr. Merrill concluded interestingly as follows:—

"I feel that many of your members would be interested to receive regularly the publications of the National Fire Protection Association, and to enjoy the other privileges of membership in that organization.

"We feel that the fire waste is a national, not a sectional question. The East helps bear the losses of the West and the West those of the East. The burning of New York this year or next year would cause a greater calamity than did the burning of San Francisco, from which, with the aid of the nation, you have so wonderfully recovered.

"The significance of the Fire Waste is apparent and the remedies are at hand. I recite no new truth and I prescribe no untried or sensational cures for the ills we all recognize. The evil and uncontrolled spirit of the flame has taken a greater toll of human life and is responsible for a greater destruction of property than all the wars of recent years. Therefore, let us defend ourselves, using practical methods of proven value. I submit the following:—

Fire Inquests.
Instruction in the Public Schools.
Rigid Building Laws.
Explosives and Combustibles Safeguarded.

Deparments of Public Safety divorced from politics and furnished with modern apparatus.
Enforce the National Electrical Code and Exclude the Parlor Match.
Fire Marshal Laws.
Eradicate Conflagration Conditions.
Never be careless of the dangers of fire, and do not permit those about you to be careless of the dangers of fire.
Separate high pressure water systems for fire services where conditions warrant.
Educate the public.

"I wish this poor cryptogram were less simple, that it might be read more than once. I could wish it more sensational, that it might attract attention. But the greatest doctrine ever given to the world has gained nothing during nineteen hundred years by attempts to distort it, and in this matter the greatest amount of lasting benefit may perhaps come from stating the facts as we know them, and recommending as frequently as possible practical relief measures of established value."

An equally important service was rendered by President Merrill in December when he made another special trip to New York City to speak at the seventh annual convention of the National Association of Cement Users (one of our active members) held in Madison Square Garden on the 13th.

As is usual in the case of important meetings in the metropolis the press gave a wide publicity to the occasion of the President's speech, many of the principal dailies of the country giving prominent headlines and printing leading paragraphs telegraphed from New York.

In his talk before the Cement Users Mr. Merrill said in part:—

"The National Fire Protection Association, as its name indicates and as its Articles of Association state, was organized to promote the science and improve the methods of fire protection and prevention; to obtain and circulate information on these subjects, and to secure the co-operation of its members in establishing proper safeguards against loss of life and property by fire.

"From a small beginning made about fifteen years ago, the organization now comprises a large membership, and is unique, I believe, in listing ninety of the principal National Institutes, Societies and Associations and Insurance Boards in America as active members. Among these we are proud to point to the National Association of Cement Users, for, as a fellow townsman of mine stated at your last annual meeting, the cement user is a true conservator, in that he draws upon a material which would otherwise remain inert and useless for all time.

"The National Fire Protection Association stands for conservation of the Created Resources of America. We believe that the fire waste is of great importance as affecting the material welfare of the nation as a whole, and is of direct obligatory and pecuniary interest to each one of us having families to protect and property to preserve for our family's use."

Mr. Merrill then spoke of the extent of the fire waste and dwelt at length upon the specific efforts being made to reduce it, describing the work of the National Board of Fire Underwriters and the Underwriters' Laboratories. He concluded:—

"All of this points among other things, of course, to the necessity for doing away with combustible material in building construction and equipment, and adds its force to the arguments you have to advance for the use of Cement. I feel that many of your members would be interested to receive regularly the publications of the National Fire Protection Association, and to enjoy the other privileges of membership in that organization, just as I feel it is decidedly to my advantage to enjoy membership in the National Association of Cement Users.

"Quoting again from my fellow townsman, Mr. Northrop: 'One of the greatest demands made upon science in these modern days is the effort to conserve our resources, and in that connection you gentlemen may be characterized as genuine conservators. I am told that you make everything which man needs during and after this life with cement; that from the time we are ushered in upon this earthly scene we are likely to be cradled in cement, to live in houses of cement, to do life's

work through instrumentalities of cement, and finally, when we have shuffled off this mortal coil, our remains are to be laid away in coffins of cement, to await the sound of the final trumpet. You are, therefore, no less benefactors of the race than he who makes two blades of grass grow where but one had grown before. When you commit our mortal dust to the dust of mother earth in caskets of dust, you leave the trees, which else had been wrought into our last covering, to wave in the forests, or to be used for the living and not the dead. You are all the more true conservators in that you draw upon a material which otherwise would remain inert and useless for all time. Now, we behold this otherwise useless material rising into splendid edifices, into beautiful cities, and taking on many forms expressive of our civilization.'

"From this it follows that in the work of the National Fire Protection Association we may count upon your continued support and helpfulness, and we on our part may co-operate as we have through membership on such of your committees as the services of our individual representatives may be deemed useful, thus bringing together through thoroughly neighborly relations our common agencies for the general good,—to the end that by such united resistance some headway may be made against what many of us believe to be the greatest enemy of mankind in America to-day,—the evil and uncontrolled spirit of the flame."

A very interesting and valuable contribution to our cause was made by three of our prominent New York members, Mr. E. T. Cairns, Mr. E. P. Boone, and Mr. W. D. Grier in a series of lectures on fire protection delivered before the senior class of the Stevens Institute of Technology. Mr. Cairns' lecture was on Fireproof Building Construction: Mr. Boone's on Automatic Sprinkler Protection; and Mr. Grier's on Factory Construction.

While practically nothing regarding fire protection or prevention is yet taught in the technical schools the value to the students of lectures from three such acknowledged experts as our above-mentioned members is obvious, as is also the value to our cause which must accrue from a body of students going out into technical careers with some comprehension of their responsibilities in this direction.

An admirable campaign of education on the fire waste and the need of better building is being carried on in the city of Boston by the Boston Journal, which might be profitably imitated by enterprising newspapers of other cities. The plan of the Journal is to make specifically hazardous portions of Boston the points of editorial attack and indicate what restrictions should be thrown about any increase of hazard. Following these editorials, and alternating daily with them, the Journal has published prominently headed interviews with Boston citizens who are supposed to know about the local conditions. Recent interviews with Mayor Fitzgerald; Fire Commissioner Daly; Secretary Wentworth of the National Fire Protection Association; and President Wheelock and Secretary Cabot of the Boston Board of Fire Underwriters have been published. Such agitation is invaluable in its effect and is bound to make easier the enactment of all state or municipal laws restricting hazards and compelling more effective protection.

Secretary Wentworth spoke in November for the Pittsfield, Mass., Board of Trade, and at the annual banquet of the Newark, N. J., Credit Men. In December he spoke at the monthly dinner of the Newburyport, Mass., Business Men's Association, and also appeared as a witness before the Legislative Investigating Committee of the New York legislature. His testimony on the latter occasion was given wide publicity by the press of the country.

The Secretary has made a number of interesting speaking engagements for February, including the fiftieth anniversary of the Chicago Board of Underwriters, February 21st; the meeting of the Chicago Credit Men February 20th, and meetings of the Credit Men and other business organizations in Rochester, Buffalo, Pittsburg and other cities.

An event of great importance in the direction of the education of the public is the active campaign just undertaken by the Committee on Publicity of our active member the Union. Mr. H. N. Kelsey is chairman of this committee and Mr. T. R. Weddell has been appointed secretary. Following the effective activity of the National Association of Credit Men, the Union is the second of our active members to co-operate in our publicity work by underaking on its own initiative a campaign of education against the fire waste. It is not the present intention of the Union committee to furnish technical information to the public, but to follow the same line in which the Credit Men and our own publicity department have been moving, which is to set out the common causes of fire and endeavor to induce the average citizen to recognize his responsibility for the same.

It has long been a matter of regret with us that the rank and file of the constituency of our active member the American Institute of Architects did not take a more direct interest in the fire waste and its curtailment. Following the splendid paper by President Irving K. Pond, "The Architect and Fire Prevention," presented at our last annual meeting, a development is taking place within the Institute itself which is certain to be of much importance. This development includes the appointment by the local chapters of a committee on public information, and the first knowledge that comes to us of the activity of such a committee is from Philadelphia, where the committee is of two years' standing and the present chairman is Mr. D. Knickerbacker Boyd. At a recent meeting of the Philadelphia chapter of the Institute the evening was devoted to a conference on fire protection and equipment of buildings and cities. There were present representatives of the National Fire Protection Association, the Factory Mutual Insurance Companies, the Philadelphia Board of Fire Underwriters, and a number of city officials and other distinguished persons, including the Director of Public Safety, Chief of the Bureau of Building Inspection, Chief of the Fire Department, Chief

Engineer High Pressure Department, President of the Engineers' Club, Instructor in Engineering, University of Pennsylvania, President of the Master Builders' Exchange, and others.

Chairman Boyd presided, and in reference to the National Fire Protection Association, said:—

"These people have in their own practical way, by discouraging the use of combustible materials in building construction, been doing more for the conservation of our natural resources than almost any other agency.

"We find that when their suggestions are followed, charges are reduced to a minimum, better construction is the result, and better protection of life and property is obtained.

"In thus placing a premium upon good construction what they do in reality is to put a penalty upon poor construction and it falls upon us, the Architects, Engineers and Builders, to co-operate in this great movement by convincing those who have capital to invest that it is to their financial advantage to use only permanent materials.

"It behooves us, therefore, to come together in such meetings as these, and to exchange helpful suggestions, the published results of which will awaken the public to a livelier interest in their own welfare."

Mr. Herbert P. Onyx, representative of our active member the Associated Factory Mutual Insurance Companies, then presented a most interesting paper, of which the following is an extract:—

"The curtailment of the enormous fire losses we have sustained in our country will not be accomplished until the subject of Fire Prevention and Protection has received the same consideration by the general public that has been given to the stamping out of contagious diseases. Fire, like disease, has its origin in many sources; records show that fires have originated from over one hundred different causes, fully half of which can be traced directly to carelessness or indifference; negligence and ignorance contribute largely to the heavy burden of fire tax which is shouldered by the public in general.

"How long would the citizens of any community tolerate a condition that would be conducive to the spreading of a contagious disease? Unfortunately the general public is not aware of the conditions existing in many buildings throughout the land, which could justly be called 'death traps,' and cause as much heartache and sorrow as the average disease epidemic—in fact the chances of a fight for life are far less in many existing 'death traps' than they would be in an epidemic of disease.

"We are coming out of the dark ages of waste and extravagance, but while we have made wonderful progress in the various arts, sciences and industries, future generations will marvel at the extravagance that was so long tolerated by us; we will be looked upon as having burned up in thirty years four and one-half billion dollars, in spite of the fact that an equal amount was expended in fire protection. Here is certainly room for thought and action on our part, especially when it is considered that property destroyed by fire represents values absolutely wiped off of the face of the earth, and which cannot be replaced.

"Although it would be unreasonable to assume that fire can, under all circumstances, be prevented, it has been repeatedly demonstrated, that where the constructive features and proper protective appliances are installed and properly looked after, the loss from fire can be reduced to such an extent that the cost of insurance is so low as hardly to become a factor in the expense account.

"The economic conditions governing the success of a manufacturing or mercantile industry to-day demand that the business shall not be interrupted by fire—in fact business men are expecting more and more from their architects and engineers

in this direction, and the time is at hand when the obligations of the architect and engineer to his client in the design and execution of any form of structure will not be fully discharged unless he has assured him that the means of preventing and protecting the property against fire have been thoroughly considered in the evolution of the plan.

"The National Fire Protection Association has a well organized laboratory which is doing a wonderful work in the promotion of better standards, both in construction and in protection, and the doors are always open to you gentlemen, as it is fully realized that architects and engineers and builders are the direct medium through which the advancement in the curtailing of fire losses can be most successfully accomplished."

Mr. Onyx followed his paper by a suggestion made more timely by the fact that the Director of Public Safety was present in person, that organized and systematic inspections of buildings be made by members of the regular public Fire Departments under direction of the Bureaus of Public Safety, backed by proper legal authorization.

Mr. John H. Kenney, Assistant Secretary of the Philadelphia Fire Underwriters' Association, explained the aims and objects of the work of that body. He said:—

"The reduction of the fire waste is the Association's principal object. The making of rates by schedule and by minimum is for the purpose of securing that and to receive from the insuring public sufficient income to pay losses and to make a reasonable and only a reasonable profit in the business.

"During the past several years, it has been the practice of many architects and builders to confer with the Association on almost all buildings of importance which they have constructed. Result of these conferences has been better constructed and protected buildings and lower insurance rates.

"As noted by Mr. Onyx, the National Fire Protection Association is doing very valuable work. In addition to its general work, it is now maintaining a Publicity Bureau. This Bureau uses every available channel for acquainting the public with fire hazards, and its recommendations for reducing fire waste. In addition to publications of the National Fire Protection Association, one of its active members,—the National Board of Fire Underwriters,—has published what is known as 'The National Building Code,' recommending that this be adopted by municipalities as their code. This has been done in some instances and in others it has been largely used, some changes being made to care for local conditions. In addition to the publications of the National Fire Protection Association and the National Board of Fire Underwriters, many insurance companies, inspection bureaus, local boards, etc., have issued pamphlets referring to the desirability of having well-built and well-protected structures, good housekeeping and general supervision. Inspectors visit manufacturing and mercantile establishments, warehouses and other properties for the purpose of using their influence to keep the premises in a clean and safe condition. The local Association does a large amount of this work and as a result of its efforts in this direction, many standpipe and hose systems, wired glass windows, fire doors, fire shutters, fire pails, extinguishers, etc., have been provided, broken windows repaired, unsafe chimneys made safe, dirty buildings cleaned and conditions in general much improved.

"The relationship between the Bureau of Building Inspection and the Association is harmonious and it affords me pleasure to acknowledge the services being rendered to the public by this Bureau.

"It is the desire of the Association that architects, builders and the general public visit our office and confer with us in reference to the construction and protection of property and the reduction of the fire hazard."

Mr. Kenney had with him copies of all the Rules, Regulations and Suggestions issued by the National Fire Protection Association, as well as a copy of the National Code, any of which he stated would be gladly furnished to architects or engineers upon request. At the suggestion of the Chairman, Mr. Kenney said he would furnish a list of all these documents, and the Chapter's Committee on Public Information will send a copy of the list to each member.

Other speakers addressed themselves to subjects local to Philadelphia; the fire department, the high pressure system and the congested districts of the city.

The value of such work and such conferences, if generally extended throughout the country, would soon place the architects in the front rank as educators. That there is reasonable ground for hope in this direction is indicated by a most interesting letter received by Secretary Wentworth from Chairman Boyd of the Philadelphia Chapter, under date of January 14th, containing the following paragraph:—

"You will be interested to learn that the first organization, other than the two in Pennsylvania, to have a Committee on Public Information was the Boston Society of Architects. The Southern Pennsylvania Chapter and the Illinois Chapter have also appointed Committees, and others are considering doing so. Furthermore, I believe it quite likely that the Institute itself will, at its Convention in San Francisco on the fifteenth of this month, appoint a National Committee on Public Information—at least the present intention is to present this matter to the Convention for consideration."

Should the national body of architects undertake any such publicity campaign against the fire waste as is being prosecuted by the National Association of Credit Men, the average citizen who now throws matches into waste baskets might think something had broken loose in this country. It is only by concentrating every possible influence in public education that we may hope for any good results. All hail to the architects! They have remained in their tents long enough. The fight outside is calling them. May they hear it—and get into it; following their Philadelphia advance guard.

Mr. W. B. Goodwin, Chairman of the Committee on State Fire Prevention Associations, spoke at the annual meeting of the Kentucky State Association last month, and has been exceedingly active during the past quarter in connection with the Ohio State Association, and the state and city building codes the adoption of which it is furthering. Chairman Goodwin's report, which will set out what has been done by all the state associations during the past year, will be of striking interest to the annual meeting.

Publicity Bureau Bulletins.

Note.—By recommendation of the Executive Committee that the general membership be brought in touch with the Publicity work of the Association there are printed below sample bulletins which have been transmitted to N. F. P. A. correspondents for publication in local newspapers. Members and correspondents are at liberty to quote from these articles, or reprint the same entire, without reference to the Quarterly.—Editor.

Bulletin No. 12. Sleeping Over Gunpowder. During the conflagration at Lenox, Mass., while the fire in the Clifford Block was at its height, a young woman was seen to climb out of a flame-filled room onto a veranda on the second floor, with her night clothing and hair ablaze. The intense heat prevented any rescue; to approach the structure was impossible. Staggering to the veranda railing, the girl leaped to the sidewalk beneath, landing in a flaming heap within five or six feet of the blazing walls. Some of the terrified onlookers attempted to rush in to drag her out, but the heat drove them back. She died in agony before their eyes, her body burning to a crisp. Five other persons were burned to death in the same building.

It is impossible to read the story of the Lenox fire and its lamentable destruction of life without reflecting upon the carelessness, or worse than carelessness, of the habits of the American people. The storage of highly inflammable substances along with explosives in a building occupied also as a dwelling by several families seems the very acme of irresponsibility. Gunpowder, dynamite cartridges, turpentine and oils occupied the basement of a structure, and sleeping persons occupied the upper floors. However the fire may have started, it is certain that under these conditions it was bound to spread with rapidity and violence. Highly inflammable subsances are a danger to life and property in any building, however carefully kept by themselves. So are explosives. When, therefore, both classes are stored together, and underneath a building filled with resident people, the risk and danger is almost incalculable.

The American people seem quite unimpressed by the stupendous property fire loss of the country, which averages $250,000,000 per annum; but the loss of life in the manner witnessed by the onlooking crowd at Lenox sends a shudder over the country, and prompts the question, "Why did the fire spread so rapidly?" Dynamite, gunpowder, turpentine and oils, all stored in close company and loosely with other articles, with only a wooden floor or two between them and a dozen or more people housed above—that is the answer.

American laws are singularly lax in regard to the hazards of explosives. Most of the states have something to say about their transportation; but the regulation of their storage is left almost wholly to the towns and cities, who usually do nothing about it until compelled by such disasters as that at Lenox. The English regulations demand that gunpowder up to 200 pounds shall be kept in a fireproof place away from houses and public places, or in a detached building used exclusively for the purpose. In no case may other explosives or highly inflammable substances be stored with it, or otherwise than at a safe distance. It is certainly no difficult thing to do, and it ought not to be too much to ask of persons dealing in explosives and highly inflammable oils and other substances that they provide a tin-clad shed or detached building for the storage of such things. It is reasonable to suppose that the people of Lenox must feel a very considerable public responsibility for the six lives lost in the recent fire, and be disposed to take steps immediately to obviate the recurrence of such a disaster. Towns and cities may well take counsel of Lenox's misfortune, and clean the explosives and inflammable wares out of their basements and cellars by municipal law before it is too late.

Bulletin No. 13. How Fire Lurks in Waste. One of the things the average man knows little about is the chemistry of fire. He hears occasionally of fires from spontaneous combustion, but his ideas of the process of spontaneous ignition are vague; and his knowledge of the substances or combinations of substances susceptible to such ignition is limited. It is difficult to acquire the knowledge outside of the chemical laboratories; for in the common run of experience unless fires from this cause are discovered at their inception they soon destroy all evidences of their origin. Such fires are commonly reported as "probably incendiary," or of "mysterious origin."

The chemistry of spontaneous ignition is simple. Decomposition is a slow combustion. The human body slowly burns to ashes in the grave. Oxygen uniting with carbon produces heat. If they unite rapidly enough, in sufficient quantities, the combustion is visible in flame. If they unite slowly, as in the decay of organic bodies, the heat escapes unnoticed. Rapid chemical action will start visible combustion as easily as the application of the torch. Vegetable oils spread over easily carbonized substances such as cotton rags or waste will ignite the latter very quickly. The cotton fibre furnishes a sort of tinder. Animal fats like tallow, butter and lard, especially if rancid, will ignite under condition similar to the above, but they are not such great offenders as the vegetable oils—cottonseed, nut, castor bean, olive, and especially linseed.

An oily rag or oily waste never should be thrown into a rubbish heap. Many fires start in closets from such rags after use in oiling floors or polishing furniture; and factory fires are occurring constantly from spontaneous ignition of turpentine and linseed oil on rags and waste.

There are not many men who give the same thought to this danger in their homes that they give to it in their factories, where metal waste cans with self-closing covers are generally provided. At the time of spring renovations, however, it is well to keep an eye upon the domestic establishment, with this hazard in mind, as servants are generally quite irresponsible. Products of petroleum such as kerosene, gasolene and naphtha, although they do not ignite spontaneously, have a hazard of their own, and rags soaked in them should be carefully looked after. A house rule should be made that all greasy or oily rags be burned in the cook stove without delay.

In the development of rapid transit along the lines of trolley cars and automobiles, the problem of flying dust has been immeasurably intensified and confronts all lovers of cleanliness. Ordinary broom sweeping simply stirs it up to settle again on floors and furniture. The vacuum cleaner has not yet developed to the point at which its constant use is commercially expedient. An endless procession of floor oils and sweeping compounds has therefore come upon the market, some of which are not hazardous, but others of which are already demonstrating their ability to burn the buildings in which they are used.

Prof. John H. Bryan, principal of the ward schools of Marion, Indiana, who evidently looks after the physical as well as the mental welfare of his pupils, stated at a recent meeting of school superintendents that twice recently he had found mops used by the janitor in oiling the floor, burned to ashes, it being evident that the building each time narrowly escaped being fired. To prove the nature of the trouble Professor Bryan saturated several mops with the oil and hung them where there were no inflammable surroundings. A mop saturated with oil at 5 p. m. was found to be very warm at 7 a. m., and in one instance Professor Bryan watched a mop until it burst into flames. It is possible that the fire which caused the frightful holocaust at the Collinwood school may have started in this way. At any rate Professor Bryan's experiment proves that the apprehension of many people regarding the hazard of these floor oils is well founded, and that care should be taken to make sure they are harmless before their use is introduced in buildings, especially such buildings as schoolhouses.

Fire Dangers of Steam Pipes.

Independence Inspection Bureau (Member N. F. P. A.)

Steam pipes in contact with wood are admittedly the cause of occasional fires, though manifestly it is impossible to make a definite statement of the relative hazard from this source. It must always be borne in mind that in fires, destruction is frequently so complete that the assignment of a cause is more or less a matter of conjecture. However, from our experience and that of others interested in this subject, we quote below a number of typical cases in which steam pipes, under a variety of circumstances, have been without question a fire cause.

There is considerable diversity of opinion as to the circumstances under which such fires may be expected to occur, and the local conditions which contribute thereto. It is self-evident that the hazard is materially increased where the heat is in any way confined, or where contact is with materials more flammable than wood. Particular care must be taken to guard against the presence of materials which are notably subject to spontaneous ignition, such as celluloid, coal dust and oily waste.

A number of investigators have attempted to produce fires by bringing steam pipes into contact with various combustible materials, but as the duration of the experiments was comparatively short, few actual fires resulted. The conclusions generally drawn, however, were that any steam pipe, no matter how low the pressure, would in course of time produce charcoal, and that when this stage was reached positive danger existed. Charcoal is unquestionably subject to spontaneous ignition. This is due largely to its peculiar ability to absorb from the air many times its own volume of oxygen. This is held in the minute pores, which exist in all forms of wood charcoal. The combination of this oxygen with the carbon may take place with sufficient rapidity to raise the temperature to the ignition point. Furthermore, charcoal formed at a low temperature is known to have a low ignition point.

Where steam is kept on a system continually there is less danger than where on intermittently, according to some investigators. The reason advanced is, that when allowed to cool the charcoal has a better opportunity to absorb oxygen than if kept hot at all times. Another factor is moisture. Experiments have shown that charcoal, once wet and dried out afterwards, is more dangerous than that which has remained dry, ignition points being well below the boiling point of water in a number of laboratory tests.

In our opinion reasonable precautions should be taken to keep steam pipes from contact with woodwork or other combustible material. This is of more importance with high pressure than with exhaust steam pipes, and more so in confined spaces than out in the open where there is free air circulation and freedom from accumulation of combustible dust and dirt.

Below we quote a number of specific instances of steam-pipe fires, which are from reliable sources:—

Low Pressure Steam Pipes in Contact with Woodwork

1. **Newspaper Company.** The inspector reports that "floor was opened up in my presence by the firemen. The woodwork was found smouldering directly at the point where the radiator supply pipe passed up through the wooden floor."
2. "Floor directly around radiator riser found smouldering."
3. **Dry Goods Store.** "I have seen a section cut from a heavy timber, eight inches by ten inches, through which a one and one-fourth inch steam pipe passed to supply radiator. The boiler which supplies this heat blew off at twenty-five pounds, and the ordinary pressure carried was not over ten pounds. The beam in question had a ring of charcoal around the pipe hole fully two inches thick. This was in a secluded place, and was only brought to light by a thorough overhauling of the steam pipes after a serious fire had occurred."
4. **Sugar Refinery Pan House.** "Steam pipe was put up touching a heavy joist. This stick was very old and probably contained dry rot. It is absolutely certain that this fire was caused by the pipe."
5. **Fringe Factory.** "One and one-half inch medium pressure steam pipe, run snugly through 12-inch by 12-inch timber. Fire occurred three months after pipe was installed. It was put out promptly and it was found that timber had hole about six inches in diameter where charcoal had burned out. Surrounding woodwork not badly burned."
6. **Bobbin Shop.** "Steam pipe passed through brick wood-refuse box. Fire started in wood where in contact with a steam pipe."
7. **Hotel.** "Steam pipes in drying room of laundry in contact with wood. Discovered and extinguished."
8. **Store.** "Steam-heating pipes."
9. **Dwelling House.** "Steam-heating pipes in a wooden box. Discovered and extinguished in the daytime. A clear case."
10. **Printing Plant.** "Main pipe leading to top of building."
11. **Hotel.** "Woodwork in contact with pipes. Discovered before loss."
12. **Hotel.** "Woodwork in contact with pipes."

High Pressure Steam Pipes in Contact with Woodwork.

13. "Special agent making factory inspection noticed wood glowing and on examination found that it had been set on fire by steam pipe."
14. **Woodworking Plant.** "Fire caused by live steam pipe in contact with joist of floor."
15. **Woodworking Plant.** "Engineer discovered wood in a glow, not yet in a flame, where steam pipe was on wood."
16. **Woodworking Plant.** "Fire caused by steam pipes under engine room floor."
17. **Shoe Shop.** "A steam pipe supplying a McKay Stitcher passed through a hollow wooden wall. Fire was seen to start in woodwork where touching the pipe."
18. **Cotton Mill Engine Room.** "A hanger supporting a steam pipe broke and let the steam pipe down on a wooden belt box, which was probably somewhat greasy. The accident was not known and pipe remained in this position till fire broke out. There was no doubt as to the cause of this fire."

19. **Fringe Factory.** "High pressure steam pipe through double lath and plaster partitions at baseboards. Fire occurred and origin was easily ascertained."

20. **Cotton Mill.** "The fire started in engine room about 7 p. m. and is supposed to have been caused by ignition of the wooden lagging on some of the engine cylinders. The engine was a Corliss type, built by E. P. Ellis & Co., in 1888, and was a quadruple expansion, two cylinders on each side, and had large receivers above the cylinders. The cylinders, connections and receivers were all lagged with wood over non-conducting material which was applied directly to the iron. I understand also that the engine room was sheathed inside and finished in hardwood. The amount of combustible material in the lagging on this engine was largely in excess of that usually employed, owing to the size of the low pressure cylinders and the very large receivers above the cylinders. This would explain the rapid headway gained by the fire before any apparatus could be brought into use for extinguishing it."

21. **Cotton Mill.** "The fire started at a point where a three-fourths inch live steam pipe for sink supply passed through the belt enclosure. One end of the hanger had become loosened from the beam and allowed the pipe to sag and rest on the woodwork of the partition. This was near the main belt, the wind from which, no doubt, fanned the spark into a flame as soon as the charring had reached the point of ignition."

22. **Paper Box Factory.** "Steam pipe set fire to wooden casing in which it was enclosed."

23. **Newspaper Plant.** "Steam pipe carried up four stories through dumb waiter shaft to plaster paris machine. Ignited wood to which it was attached."

Steam Pipes Lagged with Wood.

24. "During the spring of 1895 the Steam Heating and Power Company of New York was overhauling some of its mains in Liberty Street, near Nassau. These steam mains had been originally laid in thick wooden casings. When they were taken out, at the time and place mentioned, these cases were perfect charcoal. Not charred brown wood, but finished charcoal. Probably the steam had been turned off and the pipes allowed to cool for the workmen, so that there was no combustion when air was let in at them; but the great convex wooden planks had been turned into as perfect charcoal in their underground retort as could have been produced in a gas works."

25. "Manufacturer of wooden pipe covering reports fire in case of 150-pound pressure steam pipe being run through unlined wooden covering. This manufacturer recommends tin and asbestos for pressures in excess of six to eight pounds.

Dry Rooms.

26. "Two fires in dry houses at points where woodwork was in contact with steam pipes. No other possible cause assignable."

27. "A steam pipe set fire to frame wall of dry room through which it passed and with which it was in contact."

28. **Piano Action Shop.** "Fire reported as starting in dry room where steam pipes had been in contact with waste wood."

29. **Pipe Organ Factory.** "Fire originated in a dry room for stock and is reported as being a 'typical fire' in dry rooms where pieces of wood had been allowed to collect against the steam pipes."

30. **Desk Factory.** "This was an ordinary dry kiln fire, such as is bound to happen ever so often in factories where steam pipes are poorly arranged and dust and small particles of wood are allowed to collect. In this case the pipes were found to be practically resting on heavy timbers, and a formation of wood gases accompanying the disintegrative and desiccative effects of heat was, without doubt, the cause."

31. **Paper Box Factory.** "Steam pipes in dry room ignited their wooden supports."

32. **Bobbin Factory.** "Fire caused by steam pipes in contact with loose bobbin stock in dryer."

33. **Bobbin Factory.** "Practically a duplication of previous fire."

34. **Pharmaceutical Supply Factory.** "A small wooden box dryer was built on iron supports, one of these broke, letting the dryer down on the hot steam pipes and fire resulted."

35. **Woolen Mill.** "A fire was discovered in the mill of a certain man and its fortunate extinction may serve to convince manufacturers of a danger from steam pipes not before thought of. The gentleman in question had placed a pine board in his wool drying room, about three or four inches above the steam pipes, to prevent wool from falling on them. A fire ensued, causing a loss of several thousand dollars before being extinguished, and a careful examination as to its origin satisfied him that the heat of the pipes had distilled the pitch from several pine knots in the board, which dropping on the pipes below had caused combustion."

Sand Dryers.

36. **Elevated Railway Car Barn.** "A fire occurred in a sand dryer of an elevated railway car barn. The fire was discovered in its early stage and promptly extinguished by the car-barn men.

"Investigation showed this fire to have started near the bottom of the sand bin on the inside immediately surrounding the entering steam pipe. This steam pipe passed through some ten inches of wood and was firmly in contact with the wood at the inside end of the hole, the timbering of the bin having sagged somewhat. This bin had been in use several years—perhaps three—and a considerable charring had taken place the entire length of the hole surrounding the entering pipe. The place where the fire originated was absolutely inacessible, from either outside or in, the bin being full of sand at the time. The start of the fire and all of the burning was confined to the space immediately surrounding the pipe on the inside of the bin. It made considerable smoke on account of insufficient air supply, but consumed only a small amount of the wood. The charred condition of the wood surrounding the pipe on the way in and the location of the starting point of the fire leaves no doubt, or even possibility, of any cause except the steam pipe. It should be stated that the weather at the time was very cold, and somewhat higher steam pressure than usual was being carried. These car-barn boilers carry from fifteen to thirty pounds steam pressure, according to the work they have to do and the prevailing temperature.

"Following this fire an inspection was immediately made of twenty-six sand dryers belonging to the company. Of these thirteen showed more or less charring at points where the wood came in contact with the steam pipe, and in some cases where the steam pipe was an inch away from the wood, the heat being communicated to the wood through the sand, and in most cases through the metal sheathing with which the bin was lined; one had been in use only four weeks and showed no charring; four in which pipe was in contact with woodwork showed no charring.

"In the most pronounced case of the entire lot, the sand dryer was some ten or twelve years old. In this case a strip four to six inches wide was charred on all four sides of the bin, and the pipe was from a half-inch to an inch away from the sides of the bin the entire distance. The bin was also lined with sheet iron."

Steam Pipes in Contact with Sawdust and Shavings.

37. **Woodworking Plant.** "A steam pipe packed in sawdust set fire to sawdust inside of wooden enclosure. The vice president of this company had seen personally one other case of dust set on fire by steam pipe."

38. **Woodworking Plant.** "Fire was discovered in shavings covering steam heating pipes which were low at the side of the room."

39. **Woodworking Plant.** "The fire was inside of the pile of shavings around the steam pipe and it was a clear case of fire from steam pipes."

40. **Steel Works.** "Fire in a wooden box containing a steam pipe packed in sawdust. A clear case—discovered in the daytime."

41. **Cotton Mill.** "Steam pipe packed in sawdust. Box on fire a number of times."

Steam Pipes in Contact with other Flammable Materials.

42. **Power Station.** "In power station of Traction Company, steam main carrying a pressure of 150 pounds passed through coal bunkers about three feet from top of same. When bunkers are full, coal is piled on top of this pipe, and in the instance in question when coal was raked away, pipe was found to be surrounded by red hot coals. Attendant states that this is an every-day occurrence, and that they merely rake the coal away from the pipe and allow the burning pieces to go with the rest into the furnace."

"While it is possible that the conditions that lead to spontaneous combustion are in some degree responsible, this is not very probable in view of the fact that coal does not lie in bunkers for more than a few hours."

43. **Railway Passenger Station.** "A fire occurred from the ignition of a feather duster which had been thrust between a steam radiator and a varnished wood wainscoted wall. Fire communicated to wainscoting and burned a small area. Extinguished by telegraph operator with a bucket of water."

44. **Carpet Mill.** "Superintendent saw a collection of flyings on top of the steam pipes, which ran along the side wall, burst into flames from the heat of the pipes, and run the whole length of the piping."

45. **Woolen Mill.** "From wool in contact with steam coil. Loss $8,500."

46. **Cotton Mill.** "Fire discovered running over two laps of cotton in contact with steam pipes. A clear case of ignition of clean cotton."

47. **Cotton Mill.** "Steam pipe packed in charcoal."

48. **Woolen Mill.** "In wool sorting room, from placing fleeces over steam pipes to warm for opening."

49. **Cotton Mill.** "From oily overalls hung to dry over steam pipes."

50. **Oil Cloth Factory.** "On several occasions oil-coated burlap has dropped on to steam pipes in dry rooms, fires resulting."

Methods of Protection.

There are two general methods of keeping steam pipes free from contact with combustible material, the first being through the use of an insulator, such as pipe covering, and the second by supporting them rigidly at a safe distance. Wherever pipes pass through concealed spaces, covering should preferably be carried for entire length, to avoid future contact with substances which may get into these spaces. The attached cuts illustrate desirable principles, which, while shown applied to certain specific problems, can be adjusted to fit practically all conditions.

Figure 1 shows pipe passing vertically through floor. Pipe covering is supported by collar below, and floor plate has been used to protect end of covering and to conceal the opening. On new installations solid covering and collars can be used, but if piping is already in place split covering, wired together, and split collars make the partial taking down of piping unnecessary. If desired, metal supporting plate can be used at ceiling instead of a collar.

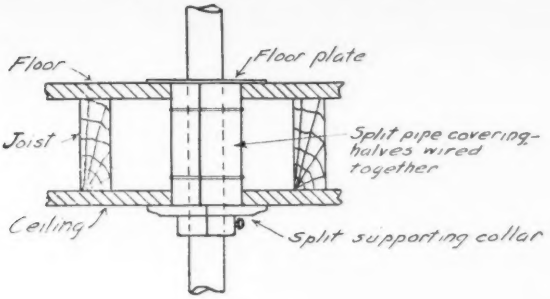


FIGURE 1

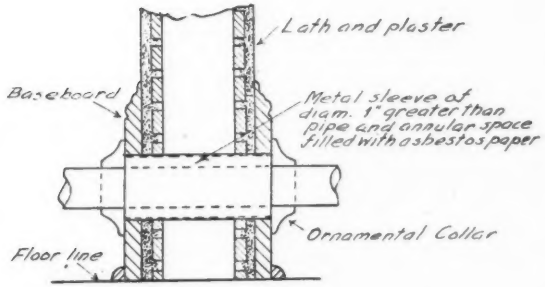

Lath and plaster
Baseboard
Metal sleeve of diam. 1" greater than pipe and annular space filled with asbestos paper
Ornamental Collar
Floor line

FIGURE 2

Figure 2 shows pipe passing through an ordinary lath and plaster partition close to the floor line. Here a sheet metal tube of diameter at least one inch greater than that of pipe, is used and the annular space filled by wrapping sufficient asbestos paper around the pipe. In the horizontal position no support is likely to be needed, and the collars shown are merely for ornamental purposes. This form of sleeve could, of course, be placed vertically as well, in which case support would be required along lines shown in Fig. 1.

Figure 3 illustrates a notched plate, which can be adjusted to a reasonable range of pipe sizes. It is, however, probably best for sizes not exceeding three inches. For larger pipe, hangers or brackets are recommended. Plates are used on one or both sides of a partition or floor, as the conditions may warrant. One-eighth inch steel plates, if well supported, will stand considerable strain. Pipe covering can be placed between two pairs of plates, as shown in illustration, or carried through partition or floor from side opposite to that on which single pair of plates is located. These plates offer perhaps the best method of keeping a pipe centrally in a hole.

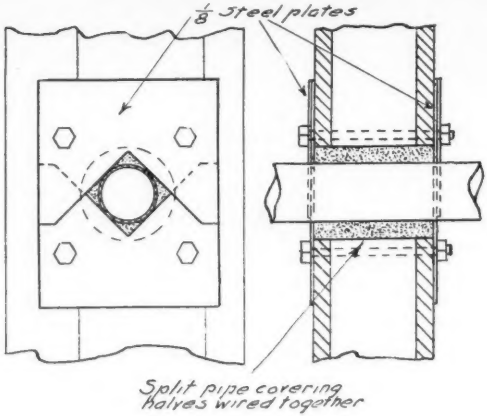


FIGURE 3

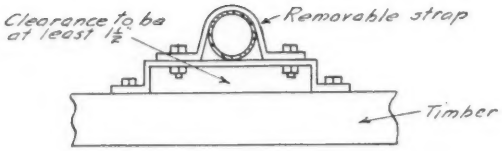


FIGURE 4

Figure 4 shows pipe supported on a bar-iron bracket, which will insure a certain separation from timber over which pipe passes. Not less than one and one-half inch clearance is advisable. The upper portion is removable, and the lower permanently secured by bolts or lag screws.

In the application of any of these methods, the following points should be borne in mind:—

First, that pipe coverings are not capable of resisting appreciable mechanical strain, and that they should be called upon to act as an insulator and not as a support. With small vertical pipes metal supports are, however, not essential.

Second, that cutting a large hole for a steam pipe is not sufficient, as a pipe is almost certain to sag, expand, or contract, and thereby come into contact with the side of hole in which it was at one time central.

Third, that a steam pipe should be covered wherever it is concealed. Even if there appears to be no likelihood of any loose combustible material getting onto pipe when same is put in place, there is always danger of accumulation of rubbish around pipes.

Spontaneous Ignition of Wool

By Benjamin Richards (Member N. F. P. A.)

The possibility of spontaneous ignition occurring in raw wool has long been discussed. Heretofore the general opinion seems to have been that wool will not take fire spontaneously. An investigation, however, discloses some well authenticated cases of fires in wool which undoubtedly originated from this cause, and leads to the conclusion that under certain conditions fires in some kinds of wool may take place from spontaneous ignition.

In general, wool must contain an excess of moisture before it is likely to give evidence of excessive spontaneous heating, although this, by no means, is a criterion of such action always taking place. Most new wool if packed closely in a large pile develops more or less rise in temperature. This temperature rarely approaches the ignition point but quite commonly develops enough heat to cause fermentation, with the result that, if not promptly handled, the fibres will be weakened and the wool depreciated in value. Excessive moisture in wool may originate from several sources. Bales may become wet from exposure before shipment, or from leakage in ships while in transportation. Wool in vessels which have been wrecked has shown the tendency to heat after the bales had been removed from the water. At times market conditions are such that wool is shipped promptly after shearing instead of lying in storage as is usually the case. Such wool is sometimes called "green" wool. It is slightly heavier and contains more moisture than wool which is allowed to take the customary course through the storehouse. Occasionally sheep are sheared when wet, with similar results to the product.

An exhaustive report of a special commission appointed by the Governor of New Zealand in 1906 gives the following interesting data relative to wool fires. The occasion for the report was the prevalence at that time of a number of fires on shipboard originating in wool shipped from New Zealand:—*

> "The yolk of wool is a fatty material and contains among its constituents oleic acid, which absorbs oxygen. In a properly packed and stored bale of wool this action nearly always takes place and is accompanied by a slight increase in weight and by the generation of a small amount of heat. This heat is nearly always concentrated near the center of the bale, as it is here that the air has practically no access, and the non-conducting properties

* Courtesy of the *Textile World Record*, Boston.

of the wool store up the heat. If the wool is moist, the increase of heat in the center of the bale becomes excessive. Where large numbers of bales are stored in the hold of a ship it is well recognized that such moisture will cause damage to the wool, even though not resulting in a temperature approaching ignition.

"From a review of all the circumstances—the reports of investigations, the opinions of scientists and the evidence which has been before your Commissioners—there is no room to doubt that spontaneous combustion does take place in wool. Numerous instances might be quoted where the interior of bales of wool has been actually on fire after being exposed to the atmosphere."

The above remarks referred to wools, such as light shrinking wools, pulled wool, "pieces" and "locks." "Locks" and "pieces" are "skirtings" or other portions taken from the fleece either purposely or by accident. Ordinary greasy wool comprised 82 per cent of the total wool shipment from New Zealand in the year covered by the above report, yet the Commissioners failed to find any evidence of a fire originating in such wool, although they admitted the possibility of such fires.

An English correspondent of the *Textile World Record* of Boston ridicules the idea that a fire originating in a bale of wool can spread beyond the bale. He states that many sea-damaged bales and bales packed while wet are for some weeks after arrival so hot in the center that the bare hand cannot be placed on the wool. Occasionally they contain fire inside, though it does not break out into flames. The chemical action is thus described: "The moisture started microbial action and the micro-organisms attracted oxygen and set up a combination of oxygen with carbon. They multiplied rapidly in conditions of temperature favorable to them, and their heat was stored and accumulated by the layers of extremely efficient non-conducting material (wool) around them. The heat increased in the affected area to such a pitch as to crisp, tender and finally char the wool at the center of operations."

A slight fire, originating in stored, unscoured wool occurred on August 20, 1909, in a wool warehouse in Boston, which seems to be typical of the action of spontaneous wool fires.

The wool was from a Western state, and at that time many of the shipments arriving in Boston were of "green" wool, the market conditions tending to hasten the shipments. The fire originated in a pile containing 2,000 to 3,000 pounds, which had been removed from the bags and on which the sorters had been at work some days. A peculiar odor had been noticed two days before the fire, which led the commission house management to assume that the wool was heating slightly, and if not given attention would be likely to be damaged by rotting. The owners of the wool were therefore advised to get the wool bagged up as soon as possible, which work was promptly begun. This led to the discovery of the fire. As the wool was removed the temperature was found to increase until finally a red hot mass about eighteen inches in diameter was uncovered. When exposed to the air the glowing wool did not burst into flame. The fire was easily extinguished, but the heat and smoke had damaged the wool to quite an extent around the seat of the fire.

An examination of the wool near the fire showed that it contained much manure, and so samples were tested for spontaneous ignition to determine what connection, if any, the presence of this foreign matter had with the fire. The tests showed no excessive temperatures resulting, and it is assumed that the presence of the manure did not tend to cause spontaneous ignition or heating.

While there appears to be no doubt that wool may be subject to spontaneous ignition, it is interesting, in reviewing the data at hand, to note that they record no fires as having positively occurred in clean whole fleeces. Also that clean sorted wools of the class containing a high percentage of natural grease appear to have contributed no evidence of such fires. Also that the usual tests for spontaneous ignition, when applied to the ordinary commercial wools, show no evidences of heating to the ignition point. These facts lead to the suggestion that after all many of the wool fires were very likely due to foreign material in the wool. The fact that a large percentage of the fires occurred in "skirtings," "locks" and "pieces," some of which are apt to be swept from the floors of sorting rooms, and in that respect somewhat partake of the nature of waste, seems to confirm this idea.

Such a large portion of all fires is due to "misplaced material" that it appears to be perfectly justifiable to attribute to this cause a fair proportion of the "spontaneous combustion" fires in wool. Sparks, matches and oily materials are as likely to get into a cargo of wool as of cotton, and these items cause a very large proportion of the fires in cotton. Further evidence of the presence of foreign materials in wool is brought out by a recent movement in the wool trade which had for its object the reformation of wool packing with a view toward the elimination of foreign matter and false packing. In a recent article in the journal above mentioned, the editor stated that, "Sticks, stones, dirt and all sorts of rubbish are found in American wool." This article voiced the recent complaints of the wool dealers relative to the presence of jute and cotton twine and other foreign materials in the wool for which they had paid as so much weight in wool. The jute fibres are very troublesome to the manufacturer, as the stray jute or sisal fibres spoil the finished cloth. One grower was reported to have used 120 feet of sisal twine in tying up a single fleece, the twine being, of course, weighed and paid for as wool. Such abuses led the wool dealers and manufacturers to take action, and in 1908 a circular was issued, signed by twenty-seven wool houses of Boston, six of Chicago, and twenty-six of Philadelphia, stating that the signers would thereafter refuse to handle fleeces tied with sisal twine, or wool tied with an undue amount of string. Any foreign matter, such as rubbish or cotton, might easily ignite when subject to the ordinary heating common to most all wool in bulk, and thus be the cause of some of the mysterious fires in wool.

Considering the features of the wool trade which affect the fire danger as outlined above, it seems highly probable that some of the fires

which have occurred in baled wool were due to spontaneous ignition of rubbish or of fibres other than wool which by accident or otherwise had become mixed with the wool. If wool is to be habitually handled in this condition, spontaneous ignition may be accepted as one of the inherent hazards of insuring wool, but for the present it seems safe to say that the danger is confined to only a small part of the wool shipments.

The above remarks cover wool as marketed. After it reaches the mill many processes tending to create a possible tendency to spontaneous ignition may take place, such as scouring, oiling, drying or mixing with other fibres.

A Fire in a Fireless Cooker.

By W. H. Ticknor, Engineer, Fire Underwriters' Inspection Bureau, (Member N. F. P. A.)

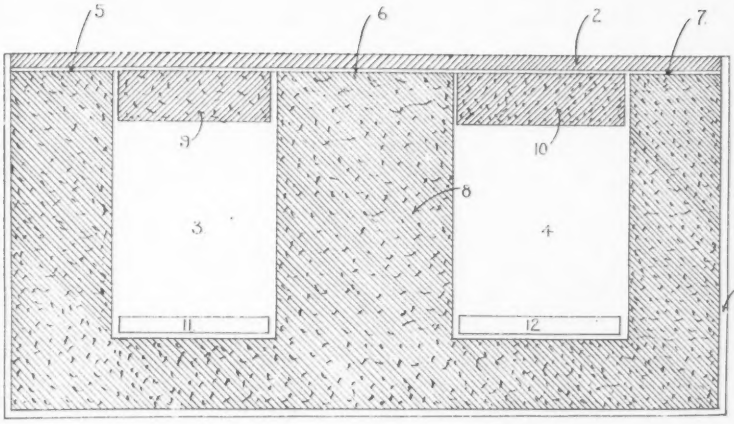
Fireless cookers are an invention of the last few years, and their possible fire hazard has not been given much attention. This, however, may not be the case in the future, as the following article indicates that fire may be caused by them.

Briefly, a fireless cooker is a receptacle so constructed that its interior is not affected by heat or cold from the outside, and in which food stuffs can be placed in a boiling state and continue boiling without a further application of heat.

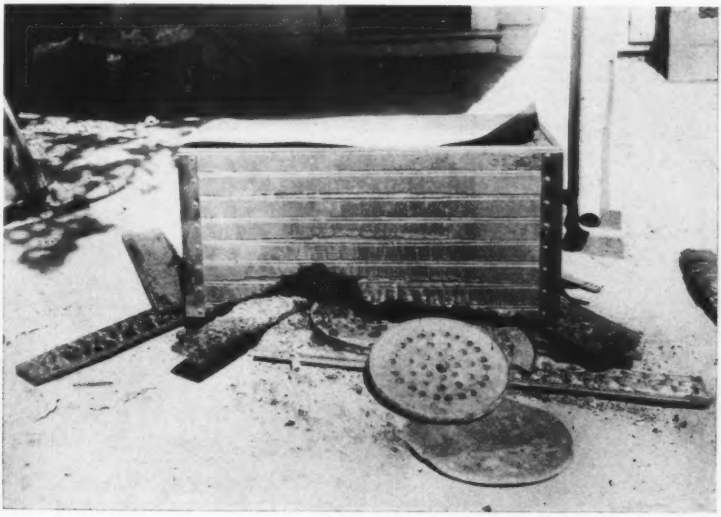
There are two types; namely, the vacuum and the excelsior-packed. It does not seem as if the former could cause any trouble, as it is constructed on the same principle as the much used thermo bottle, which, as is well known, is a glass bottle within a metal case, the intermediate space being a vacuum.

The excelsior-packed cookers are made by several companies, but the one in question is an Acme, made in Quincy, Ill.

Description. The accompanying diagram will aid in explaining the device. It is a wooden box constructed of half-inch tongued and grooved boards. Its corners are bound with steel angle irons on the outside, but it is not metal lined. The cover, Fig. 2, and the outside or top is of tongued and grooved boards. The bottom of this cover is sheet tin, and the intervening space of one inch is filled with sawdust. Three and four are cylindrical tin receptacles. Their bottoms are soldered on, and their tops are open. Five, six and seven are all part of one piece of tin, covering he top of the box before the cover is put on. It has two holes cut in it



Sectional View of the Fireless Cooker.



Cut No. 1. Side View of Cooker Resting on its Base. Tin resting on top was the inside lining to cover.

to allow admittance to the receptacles. It is nailed to the sides of the box and soldered to the edges of the receptacles. Eight is sawdust, and surrounds all sides of the receptacles. Nine and ten are covers to the receptacles, and are in the form of plugs. They are made of tin and are about two inches thick, and filled with sawdust. Eleven and twelve are cast-iron discs, which are put in red hot and the article to be cooked set on top of them.

Operation. The discs and food to be cooked are heated on a stove for about fifteen minutes, and then placed in the cooker, the disc on the bottom. The entire cooker is closed and allowed to remain so for three or four hours, when the food is found to be ready to serve.

The Fire. This cooker had been used to boil a ham, and the ham was removed at 5 p. m. The cooker was washed out at 8 p. m. and found to be cold. At 3 a. m. the inhabitants of the house woke up to find their cooker had caught fire, which had communicated to the woodwork near by. Fire was extinguished with a hose and the cooker carried outside. The entire bottom and part of the sides of the wooden part of the cooker was burned. The cover was burned and most of the soldered joints were loose. One of the heating discs was broken. There was, however, a great deal of the sawdust unburned. The cooker was destroyed and most of the woodwork in the kitchen had to be replaced.

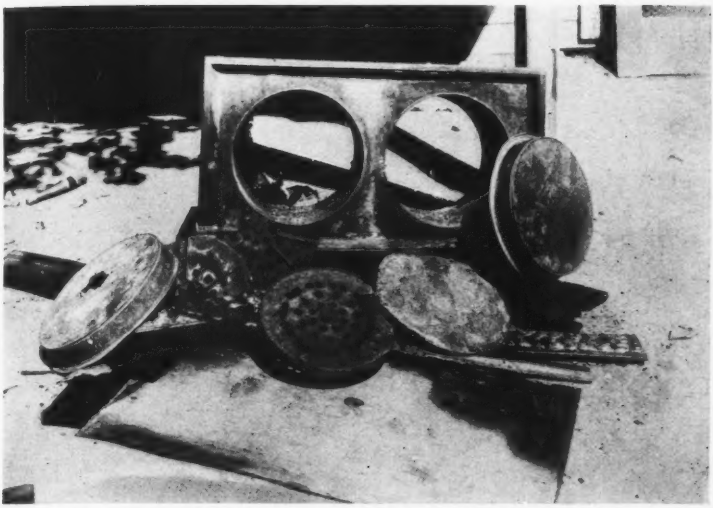
The Cause. The fire was probably caused by spontaneous combustion. This was very likely due to the sides of the receptacles sweating and dampening the sawdust, or the disc in being dropped into the bottom broke the solder and allowed grease or water to get through into the sawdust.

The Remedy. Vacuum cookers should be used, or the manufacturers should do away with all soldered joints in the tin and otherwise safeguard the device against fire.

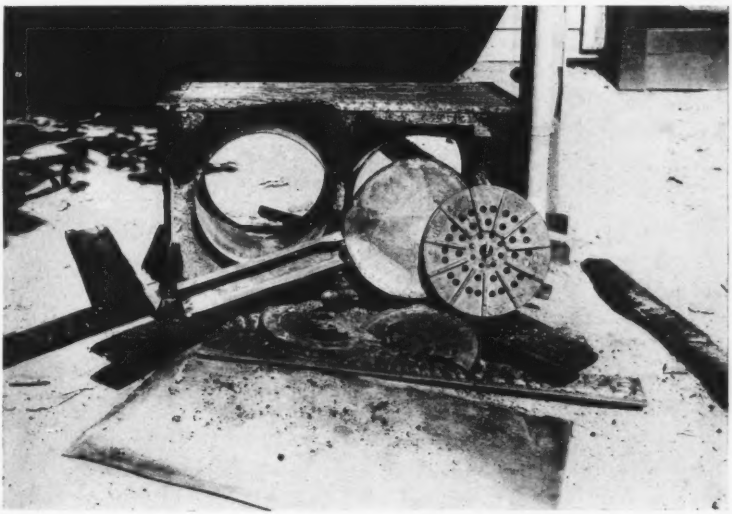
The accompanying photographs were taken by J. R. Douglas, of the Fire Underwriters' Inspection Bureau. No. 1 is a side view, with the cooker resting on what was its base. The piece of tin on top is the bottom of the cover. The round disc lying on the ground, with holes through it, is one of the discs which are heated. The round piece of tin lying under the disc is the bottom of one of the receptacles. These being knocked off, allows a clear view through the entire cooker, as is shown in picture No. 2, which is a top view. The large round disc in picture No. 2, leaning against the right hand corner of the cooker is one of the covers to the receptacles. Picture No. 3 shows the bottom of the cooker.

NOTE.—A similar fire is reported from Illinois in a device which had been in use for six years. Metal receptacle was separated from its wooden case by one and one-half inches of space packed with excelsior. Some pork was put into the cooker at 12.30 p. m. with a piece of soapstone in the bottom. At 4.10 p. m. the cooker and adjacent woodwork were on fire.

Cause of fire reported due to a leak in the receptacle allowing hot air to get into the excelsior and gradually to carbonize the same, resulting in final ignition.—EDITOR.



Cut No. 2. View of cooker resting on its side showing top and covers.



Cut No. 3. Showing the bottom of the cooker.

A Fable for Builders.

By F. H. W.

Last Summer a Good Citizen of a certain town not over a hundred miles from almost Everywhere, built a Wooden house for a Woman and her Children. He built the Chimney of Brick because he had to. The Chimney was able to Stand Alone, so he did not have to prop it with Wood. But the Floors of the house would not Stay Up without props. The Good Citizen saved a dollar by using the Chimney as a support to the floors. He nestled the ends of the Floor Joists nicely in the brick of the Chimney. He covered up the job and got his money.

The Rains fell and the Winds blew in the most Biblical manner, and Winter came after its fashion. The Chimney Settled a little; and there was a tiny Crack.

One morning the Woman woke up with Fire all About her. She tried to get to her Children. If she got to them no one Ever Knew it. The Good Citizen who built the house was Not Arrested for Manslaughter. He is building Other houses of the Same Kind for Other women and children.

He is making his Living by it.

Chimneys and Flues.

By Chas. E. Eldridge (Member N. F. P. A.)

There is no subject in fire protection engineering that comes nearer to the ordinary citizen than that of the flue or chimney in the house in which he lives. It would seem that this feature is one which should always receive paramount consideration, and yet the fire statistics demonstrate a carelessness in respect to it that is difficult to reconcile with most men's profession of love for their wives and children, who are the principal sufferers from fires in dwellings.

The ignorance and carelessness in connection with chimney and flue building cannot be laid at the doors of the people of any special section of the country, the pestilential conditions are nation-wide.

The Home Insurance Company recently reviewed 3,298 reports of dwelling house fires, of which the causes were known, with the object of ascertaining the percentage of chimney fires in the dwellings of the South, and comparing the same with the percentages in other sections of the country and Canada. The comparative tables follow, and have other features interesting to the student of dwelling house fires :—

MIDDLE AND EASTERN STATES.	Flues.	Lightning.	Incendiary.	Electric Light.	Other Causes.
Maine	22	4	7	2	19
New Hampshire	23	11	9	1	11
Vermont	7	4	2	0	5
Massachusetts	83	16	42	3	91
Rhode Island	6	0	6	1	9
Connecticut	31	5	11	2	34
New York	112	12	36	7	130
New Jersey	40	19	13	1	38
Pennsylvania	66	12	41	19	161
Delaware	2	1	0	0	5
	392	84	167	36	503

Total, 1,182, of which 392 were from flues, and said flue fires being 33 per cent of the total.

SOUTHERN STATES.	Flues.	Lightning.	Incendiary.	Electric Light.	Other Causes.
District of Columbia	5	1	0	9	5
Maryland	32	13	15	3	22
Virginia	24	9	14	2	32
North Carolina	16	2	6	2	10
South Carolina	25	6	9	1	4
Georgia	29	7	12	2	21
Florida	3	1	6	0	4
Alabama	15	8	10	3	7
Mississippi	40	4	6	3	19
Louisiana	15	1	12	1	19
Texas	114	10	18	6	113
West Virginia	5	3	4	0	16
	323	65	112	23	272

Total, 795, of which 323 were from flues, and said flue fires being 41 per cent of the total.

MIDDLE WEST.	Flues.	Lightning.	Incendiary.	Electric Light.	Other Causes.
Ohio	36	17	9	1	39
Kentucky	60	9	20	0	41
Tennessee	79	6	11	1	27
Indiana	17	11	17	0	27
Michigan	24	6	7	2	26
Illinois	17	3	6	5	23
Wisconsin	7	12	7	1	18
Minnesota	22	7	6	3	27
Iowa	7	3	4	0	16
Missouri	19	1	7	3	30
Arkansas	14	3	6	2	4
Kansas	1	5	1	0	7
Nebraska	12	8	5	2	18
Colorado	3	1	3	0	4
North Dakota	4	1	2	0	2
South Dakota	3	1	1	0	4
Oklahoma	6	3	2	0	5
Indian Territory	1	1	1	2	1
	332	98	115	22	314

Total, 881, of which 332 were from flues, and said flue fires being 38 per cent of the total.

ULTRA WEST.	Flues.	Lightning.	Incendiary.	Electric Light.	Other Causes.
Arizona	0	0	1	0	0
California	64	2	25	23	102
Idaho	11	0	0	2	4
Montana	2	0	5	0	2
Nevada	2	0	1	0	2
Oregon	14	0	3	1	18
Utah	3	0	0	1	0
Washington	23	0	2	2	20
Wyoming	1	0	0	0	1
New Mexico	0	0	1	1	2
	120	2	38	30	151

Total, 341, of which 120 were from flues, and said flue fires being 35 per cent of the total.

CANADA.	Flues.	Lightning.	Incendiary.	Electric Light.	Other Causes.
Alberta					
British Columbia	1	0	1		
Manitoba	1	1			
New Brunswick	4	2		1	2
Newfoundland					
Ontario	24	19	2	3	22
Nova Scotia	1	1			
Prince Edward Island					
Quebec	5			1	7
Saskatchewan					1
	36	23	3	5	32

Total, 99, of which 36 were from flues, and said flue fires being 36 per cent of the total.

It will be noted that of the total number of dwelling house fires, the South has the highest percentage caused by defective flues, 41 per cent; the Middle and Eastern states 33 per cent; 38 per cent for the Middle West; 35 per cent for the Extreme West; 36 per cent for Canada, and 36 per cent for the general average.

The Continental Insurance Company in listing the causes of 69,579 fires attributes 4,562 of the number to defective flues; fire places and open grates, 1,202, and stove pipes as flues, 125.

The following excerpts from Moore's treatise on "How to Build a Home—The House Practical," is a concise suggestion for construction of chimneys and flues, and will be found useful in any consideration of the subject.

"All chimneys should be built from the ground; the walls should not be less than eight inches in thickness, and the flues will be improved, from fire-resisting and draft view points, if lined with a burnt clay or terra cotta flue lining. It is quite common to erect chimney flues only four inches, or half a brick, in thickness. Such flues are very dangerous. In view of the fact that it costs very little more to make the flue-wall eight inches in thickness instead of four, such neglect is simply criminal. A chimney with only

four inches of brick work, especially in the side next the weather, makes a cold, chilled flue and a bad draft.

"Carpenters not infrequently fasten their work in process of construction by driving wooden pegs into chimney-breasts. In the case of a four-inch flue-wall there can be but one result.

"Before deciding upon a 'half-brick' chimney, ask your architect how much additional it would cost you to build an eight-inch chimney. You will probably not only build an eight-inch chimney, but you will line it with burnt-clay pipe. If, after learning the extra expense, you are willing to risk your own life for the difference, and do not regard the safety of your family, read what kind of a man St. Paul says is 'worse than an infidel.'

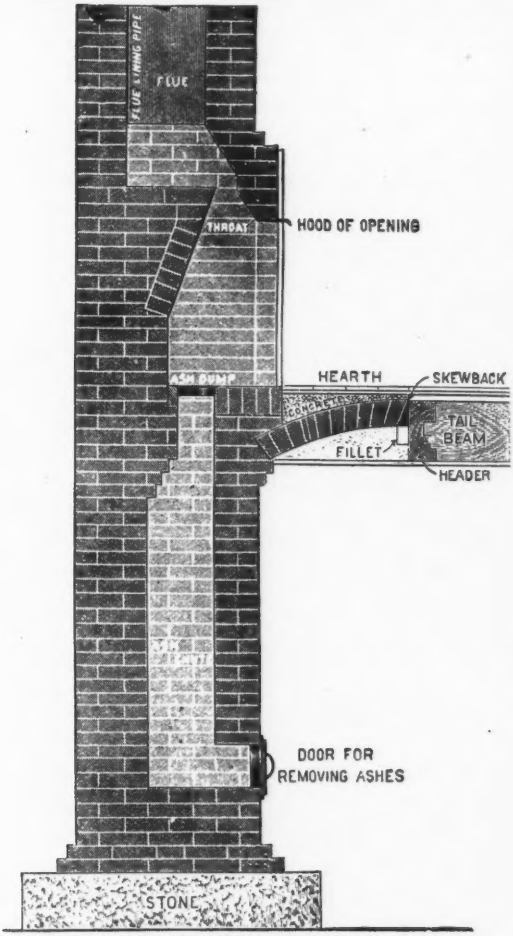
"Be sure to decide upon the number of fireplaces and chimneys required before getting estimates. They cannot be introduced after the building has been begun without risk of dangerous construction and the certainty of added expense.

"All floor timbers should be 'trimmed' clear of the hearths and brickwork of the chimney, so as not to be in contact with it at any point. This is easily secured by what are known as 'header' beams, carried in front of the fireplace and at least twenty inches from the chimney-breast, supported by the 'trimmer' beams, which enter the wall on each side of the chimney. These should not approach the side of the chimney closer than four inches. The intervening 'tail' beams, as they are called, are mortised into the header. Where more than three tail-beams are framed into the header, however, it should be supported in 'stirrup' irons (sometimes called 'bridle' irons), by which the weight is carried on the trimmer-beams without mortising into them by 'tenon and tusk' joints, which sacrifice material and carrying capacity. In this way the floor-beams are free of contact with chimney flues. The building law of New York City requires (what should not in any case be neglected) that all hearths shall be laid on trimmer arches of brick carried across from the chimney-breast to the header-beam already described, so that the hearth shall not rest upon or near wooden beams in any case. This whole matter is more fully explained by accompanying illustration.

"Where a chimney passes through the roof it should be flashed with copper to prevent leakage. Under no circumstances should the brickwork of the chimney be extended out over the roof by the projection of the course of brick nearest to it. Such a shoulder or overhanging projection will inevitably cause cracks in the chimney in case the chimney settles, the roof in such event lifting the upper portion by means of the overhang, or shoulder, and causing a crack at the most dangerous of all places. The chimney should be carried up of uniform thickness to the top, copper flashing being relied upon to prevent leaks.

"The chimney should be coped with a three-inch blue-stone, and it is important to see that the holes cut in the capstone correspond in size with the flues; otherwise shoulders will be formed and the draft of the flue interfered with.

HOW TO BUILD A CHIMNEY



SECTION OF CHIMNEY SHOWING TRIMMER ARCH UNDER HEARTH, PROPER CONSTRUCTION OF FIRE PLACE, FLUE AND FLUE LINING, ASH CHUTE, ETC.

"Flues in throat capacity should not be less than eight inches square on the inside, and for fireplaces in which wood is to be used they should be eight by twelve inches in the clear. Green or unseasoned firewood will require a flue of this size to insure a good draft and prevent smoking. The furnace flue should also be not less than eight by twelve inches in any case.

"Be careful to see that the flues are built according to the specifications, and that details recommended are not ignored by the mason. If not watched at the time the chimney is being constructed, faults cannot be remedied afterward. The chimney should be so planned as to carry the flues as nearly straight as may be to the top. A horizontal or flat flue built in a straight way should never be allowed. All flues should be as nearly vertical as possible.

"Masons are often careless about lining the flue even where the specifications call for it, and are apt to omit it until they get to the straight part of the flue. This makes the flue dangerous at its hottest point, near the fireplace, especially where it is surrounded by only four inches of brickwork, and it is important to caution your architect and his inspector, and perhaps to look after the matter yourself, in order to make sure that the flue-lining is carried up from the throat of the fireplace, as called for in the specifications.

"Where flue-linings are not provided be careful to see that all joints are struck smooth on the inside, and that projections of bricks or mortar are not allowed, and also that no parging or plastering of the inside of the flue is permitted under any circumstances. The plastering is liable to fall afterward, under the influence of heat and rain, and not only to stop up the flue, but to tear out the plaster between the joints of the bricks. The flue-lining will prove the cheapest in the end, for it will maintain a smooth throat for the entire life of the flue, and, moreover, will tend to prevent the building of nests by chimney-swallows, which prefer rough interiors.

"If a stove should be placed in a room in which there is no smoke-flue, and the stovepipe has to pass through a lath and plaster partition to connect with one, great care is required to make it safe. This may be done by placing a smoke-pipe guard-casing (at least eight inches larger in diameter than the pipe) through the partition, perforated with holes in its ends. If the smoke-pipe should be connected to a furnace and heated to a high temperature, then the diameter of the guard-casing should be increased to a suitable size. The stovepipe should not be placed closer than six inches to woodwork, and at this distance it is always well to shield it. In all cases where metal is used to protect wood, there should be an air space between the metal and the woodwork to be protected.

"Be sure that your architect and contractor understand the importance of building the fireplace and flue correctly, or a smoking chimney will be the result. The fireplace should not, as a rule, be higher than 26 inches above the floor, twenty-five would be better, as the higher the fireplace the more cold air will enter to prevent a good draft. The flue should ascend directly from the center of the fireplace, and if it is necessary because of fireplaces on floors above to carry the flue to one side, it should be drawn by easy inclines to the side, and, as already stated, if wood is to be used, an eight-by-twelve-inch burnt-clay lining-pipe should be inserted. Round flues usually draw better than square flues. Wherever possible a ten-inch round flue should be used, and the flue-lining should be put together with collar-

joints tightly cemented, the same as for drain pipe. Fireplaces for burning cord wood are often desired. These should be four feet six inches wide and from two feet six inches to three feet six inches high. For these large fireplaces circular flues twelve inches in diameter are advisable. A rough rule by which to gage the size of a flue is to construct it with a capacity about one tenth of that of the fireplace opening. For instance, a fireplace two feet high by 40 inches wide would have an opening of 960 square inches, and therefore a flue eight by twelve inches, or 96 square inches, would be the proper size. Where the flue has a smooth throat and is lined with terra-cotta pipe, it will answer for a somewhat large fireplace. In fireplaces height counts for more as an objection than width; the lower the fireplace the better will be the draft. You cannot be too watchful of the building of your flues.

"The brickwork of the back of the fireplace should be brought forward, commencing at a point six courses of brick from the hearth. This tends to contract the flue toward the top of the fireplace, and to insure that the air at this important point is thoroughly heated, which greatly improves the draft.

"Where these precautions have been neglected and the fireplace is too high, a smoking chimney may sometimes be corrected at small expense by a sheet of metal carried across the top, four or five inches wide, folded over at the top, so that the flap will fasten in behind the brass frame and hold it in place. This serves as a curtain and prevents the smoke from puffing out in front at the top of the fireplace. A more permanent and sightly arrangement will be to have the brass frame of the opening made wider at the top, or the tilework may be carried down even after the brickwork has been finished; but it is well to experiment with metal of different widths until the proper height is ascertained.

"A smoking fireplace is often caused by an eight-inch-thick top to the opening or front of the fireplace. The brickwork crossing the top should be beveled back so as to run from four inches thick at the front, back and upward. This may be secured by brick made two and a half by twelve by eight inches, beveled off from four inches at the bottom to eight inches. The same effect may be secured by a brass hood for the frame, beveled back, so that the tendency of smoke and air will be upward and without obstruction. Insist on having your chimneys and fireplaces built as per illustration.

"It will be found true economy to have fireplaces in all rooms where it is possible. They are not only desirable for heating a room in an emergency, but are valuable for purposes of ventilation. It is best to line them with firebrick (or cast-iron), and cheapest, also, in the end.

"Where the chimney-breast over the fireplace or mantel is 'furred out' and finished with lath and plaster, as is sometimes the case, only metallic lathing should be used. It is well to fur out the breast with metallic lathing in this way in order that the paper of the room may be kept dry; otherwise on damp days, when the percentage of humidity in the atmos-

phere is high, the warm, moist air of the room will condense on the cold chimney-breast and in time injure the paper; so that furring out with metallic lathing, leaving an air space behind, will correct this fault.

"Under no circumstances should there be any wooden furring or lathing on a chimney-breast.

"The specifications should provide for one joist or strip in the middle wall of every room, so that in case it is desired to hang a heavy mirror, a deer's head, an armor trophy, or other object too heavy for picture-moulding, this center stud may be used for the purpose. (Remember, however, that no stud or other wood should be nearer to the inside of any smoke-flue than eight inches. Four inches of brickwork, even with terra-cotta or cast-iron flue-lining, are not sufficient as a fire stop separation.) Builders and architects do not always think of such matters of detail, and permit the joists to come where they will. Any one who has tried to find such a joist by sounding the plaster, only to discover that there is no joist where it is most needed, will appreciate the value of this suggestion. Picture-mouldings are not strong enough for heavy mirrors, etc.

"In the case of chimney-breasts the wooden stud must not be let into the brickwork, but must be secured with a tinned back so that it cannot be ignited.

"In selecting mantels, especially of wood, be sure to see that the projection of the mantel is not so great as to result in its being blistered, if not ignited, by the fire. This is a matter too commonly lost sight of. Not only will the mantel soon be ruined, but there is great danger of fire."

Carbon Tetrachloride: Mixtures with Naphtha

By J. Albert Robinson (Member N. F. P. A.)

It has been a matter of deep regret amongst Underwriters and Fire Protection Engineers that no suitable non-inflammable substitute for naphtha has been found. We occasionally hear that a process of rendering naphtha non-hazardous has been perfected, but the recurrence of fires and explosions, resulting in death and destruction, disproves the practicability of any such discoveries.

The non-hazardous, but otherwise similar, properties of carbon tetrachloride are well known, but its high cost has limited its use to a very great extent, as well as a lack of information concerning its adaptability on a commercial scale.

The development of the electrolytic cells for the production of chlorine and caustic soda, with the consequent cheapening of chlorine gas, has cheapened the process of producing carbon tetrachloride. Co-incident with this, the process of manufacturing carbon-bisulphides has been improved and cheapened. Chlorine gas is passed over heated carbon-bisulphide and the products condensed in a cooler. A mixture of carbon tetrachloride and sulphur dichloride is obtained ($CS_2+Cl_6=CCl_4+S_2Cl_2$), and by introducing caustic soda or potash into the mixture the sulphur dichloride is decomposed and dissolved, the carbon tetrachloride separating and falling to the bottom of receptacle, being afterwards purified by distillation.

Carbon tetrachloride is sold in one hundred gallon drums and smaller lots in containers. It is sold by weight, there being thirteen and one half pounds per gallon. Present quotations are about ten cents per pound in drums, with an advance of from one-fourth to three cents in smaller lots; five gallons being quoted about thirteen cents.

Carbon tetrachloride is a clear, colorless volatile liquid with an agreeable aromatic odor. Specific gravity 1.604 and boiling point 78° C. It is non-inflammable and non-explosive and its vapors extinguish fire. It is an excellent medium for extracting oils from seeds, fats, animal tankage, wool, cotton, etc., and this in a shorter time than will naphtha. There is some doubt as to the ability to recover the last traces from the press cake, and this has been detrimental owing to the high cost. It has not been certain what effect the use of carbon tetrachloride would have on apparatus designed for the use of naphtha. A large number of experiments have been made to determine the adaptability of metals to withstand the corrosive effect of the solvent.

However, the use of carbon tetrachloride is meeting with favor, since the price of the material has been materially lessened. Coupled with the fact that a certain percentage of naphtha can be added without rendering the resultant mixture inflammable, it has become feasible and commercially practicable to use this mixture for many purposes, especially where the spent solvent is recovered by distillation. Cases have been brought to our attention where such mixtures were being used and claimed to be non-hazardous, and we were asked to investigate the subject, to determine how great a percentage of naphtha could be added to carbon tetrachloride and still leave the mixture free from danger of fire and explosion.

It was decided to make tests with naphtha of various gravities and varying proportions of carbon tetrachloride, tests to include flash and fire points, determined with the New York Board of Health tester; evaporation test to determine if the proportion of mixture remained constant when vaporized; and explosion test in an oven designed for this purpose, in which known quantities of vapor can be introduced and exploded. These tests were not carried out, however, as a series of tests of an exactly similar nature were conducted by Edward A. Barrier, member of the American Chemical Society, and the results in detail were published in the *Journal of Industrial and Engineering Chemistry* Vol. 2, No. 1, p. 16, issued by the American Chemical Society. This work was done in such a scientific, thorough and practical manner that it seemed needless to duplicate it, and the conclusion which he derived from his tests can be accepted without reserve. It did not seem essential to include a detailed account of his work or the tables of data obtained. As a result of his tests the following conclusions seemed warranted to Mr. Barrier:—

1. A certain percentage of naphtha can be added to carbon tetrachoride and still leave the mixture free from fire and explosion hazard.

2. The percentage which can be safely added varies with the gravity of the naphtha.

3. A 55° naphtha at ordinary room temperatures is practically free from explosion hazard, but in order to be reasonably safe from fire hazard it should contain at least 30 per cent of carbon tetrachloride.

4. A 63° naphtha at ordinary room temperatures presents but slight explosion hazard, but in order to be reasonably safe from fire hazard it should contain at least 45 per cent of carbon tetrachloride.

5. A 70° naphtha (motor gasolene) in order to be safe from explosion hazard should contain at least 50 per cent of carbon tetrachloride, and to be reasonably safe from fire hazard should contain at least 60 per cent.

6. A 76° naphtha to be safe from explosion hazard should contain at least 60 per cent of carbon tetrachloride and to be reasonably safe from fire hazard should contain 70 per cent.

The above statements apply, naturally, only to naphthas, which show approximately the same results on distillation,—especially with respect to the lower boiling fractions,—as those tested. The expression "reason-

ably safe from fire hazard" is used advisedly since the above mixtures, while possessing but little fire hazard in open containers, will burn if spread out over a considerable area on any other readily combustible material such as cotton waste. The percentages of naphtha, stated in each case, are limiting ones and good practice would call for an additional 5 per cent of carbon tetrachloride in order to allow some factor for safety.

A Fire in Germany.

Method of Inquiry and Penalty Imposed of Negligence.

Dr. James C. Bayles gives an interesting account of the method of handling fires in Germany and the rigid inquiry into the cause and the penalty imposed on those who violate the laws for the safeguarding against fires. He says, "An American gentleman, living with his family, in Berlin was one morning awakened by the smell of smoke in his apartment, and found that a fire originating in a room overhead was eating its way down through the ceiling of his dining room. He dressed, went to the street, and turned in an alarm, which in due course was responded to by the fire department. Such response is never what might be called precipitate in Germany, but is as prompt as circumstances seem to require. What is known in America as 'red tape' seems to a foreigner very much in evidence in every German official proceeding, but I was never able to observe that it interfered with getting official work done in the best and most thorough way. The fire I am describing was extinguished with chemical apparatus without any water damage and without needless destruction of walls or furniture, and before the firemen left they had removed every trace of debris and scrubbed the floors of the rooms in which they had worked.

"Meanwhile a careful investigation was made by officers equipped with notebooks, not by asking questions of tenants or gossiping with servants, but from personal observation. Next morning the gentleman who had turned in the alarm was sent for and conducted before a fire marshal, or equivalent officer with inquisitorial powers. That he had important engagements elsewhere counted for nothing. Public business never waits on private convenience in Prussia. He was asked all sorts of questions, which he was able to answer satisfactorily. The fire was known to have originated in a coal which had dropped from a laundry stove in the attic and rolled upon an unprotected wooden floor. The tenant showed that the stove was an appointment of the building, provided by the landlord, and that it was neither his duty nor his privilege to change it.

"Then the landlord was called. He showed that he had recently purchased the building, under the usual guaranty that all laws and ordinances had been complied with in construction and appointments; that he had neither set nor moved the stove in question, and that his attention had not been called to any conditions involving a fire risk. This was not considered quite satisfactory, and he was told to await further instructions. Then the builder from whom the landlord purchased, was called. He had to admit that he, as builder, was responsible for the setting of the stove as the police had found it, and that he had violated the law in neglecting to provide a suitable metallic hearth, of the required kind and dimensions, between it and the floor. For this he was held culpable.

"The assessment against him began with the estimated cost to the city of responding to the alarm and extinguishing the fire, included the damage to the furniture and property of tenants, and was rounded by an exemplary fine of 500 marks, as a reminder that laws are enacted for a purpose, and carry substantial penalties for their violation. The damage to the building was not included in the assessment against the builder. It was held that while the owner had not committed the violation of law which caused the fire, he had been negligent in not discovering and correcting it, and for this reason he should pay for his own repairs and stand charged with knowledge of his duty in like cases. That he escaped a fine was deemed a cause for congratulation among his friends. Had he owned the building longer he would undoubtedly have had to pay a fine for neglect of duty in permitting a violation of law to exist on his premises."

Bleach, Dye, Print and Finishing Works---Fire Record.

Total Number of Fires, 286

1. CLASSIFICATION OF CAUSES.

Common Causes.

LIGHTING. Number of fires, 29

Electric arc or incandescent lighting, 14 fires.

Defective arc lamp. Hot carbon dropped onto combustible material.

Breaking of arc lamp allowed hot carbon to fall onto cloth.

Caused from broken electric lamp.

Incandescent electric lamp socket grounded on iron post.

Broken strands in light cord caused short circuit and sparks.

Broken electric light cord grounded on can dryer igniting lint.

Short circuiting of drop cord on electric light system.

Short circuit of defective electric light wires.

Defective electric light wiring.

Defective electric lamp or wiring under napper.

Electric light switch was only partly turned off causing arcing, igniting bales of cloth.

Caused by arc from short circuit at generator.

Fuse blew out on lighting system igniting dust and lint.

Caused by defective fuse on lighting system.

Gas lighting, 9 fires.

Portable gas jet used in repairing shearer. Flame drawn into exhaust pipe igniting lint.

Gas jet placed too near ageing box ignited lint on box.

Truck of loose cotton ignited from gas jet.

Gas jet ignited lint in waste bag.

Employee used rags to light gas jet. Rags smouldered igniting later on.

Ignition of cloth by open gas jets, 2 fires.

Cloth from printing machine in contact with gas jet, 2 fires.

Lamps used in repairing steaming and ageing room ignited lint.

Repairing crude oil storage system. Workman ignited vapors with lantern.

Employee fell, breaking lantern and igniting combustible material.

Employee ignited cloth in steaming room with open torch.
Caused by open torch.
Employee used match for lighting, igniting covering on bale of goods.

HEATING. Number of fires, 3.
Ignition of stock piled against steam pipes.
Heat from steam pipes ignited clothing hung on them to dry, 2 fires.

POWER. Number of fires, 11.
Defective rheostat. Excessive current when switch was closed ignited insulation on wiring.
Arcing of elevator switch ignited goods.
Driving belt of paddling machine rubbed against wooden cover of gear box causing friction.
Friction in one of the collars on main shaft.
Overheating of bearings, wooden transmission ignited.
Friction in wooden belt box.
Caused by wooden pulley slipping on shaft.
Overheated bearing on shaft over dryer.
Friction or spark struck in gears.
Caused from overheated bearings, 2 fires.

BOILER (or fuel). Number of fires, 7.
Breaking of feed water-pipe back of boiler blew flames and sparks into room.
Heat from boiler stack ignited roof.
Sparks from boiler stack on roof.
Sparks from boiler stack lodged in rubbish outside of building.
Spontaneous combustion in soft coal, 3 fires.

RUBBISH (or sweepings). Number of fires, 6.
Fire occurred in sweepings from singe room.
Fire started in rubbish from box shop piled near boiler house.
Occurred in waste material in basket.
Spontaneous ignition of rubbish in print room.
Fire occurred among sweepings containing chemicals.
Spontaneous ignition of rags and rubbish in aniline color room.

OILY MATERIAL. Number of fires, 1.
Spontaneous ignition of grease and dirt back of dryer.

SMOKING. Number of fires, 4.
Lighted pipe left in coat pocket.
While lighting a cigarette, match head broke off flying into a pile of cotton.
Caused by employee smoking, 2 fires.

LIGHTNING. Number of fires, 5.

LOCOMOTIVE SPARKS. Number of fires, 0.

MISCELLANEOUS. Number of fires, 8.
Plumber's torch set fire to burlap lining of hood over can dryers.
Gasolene torch exploded.
Sparks from roofer's furnace ignited a bale of cotton warp.

Steam pipes were wrapped with asbestos and covered with sawdust and paste. Sawdust thought to have ignited spontaneously.
Steam pipes ignited wooden flooring.
Caused from matches on floor.
Rekindling of previous fire.
Gas stove left burning in wooden box.

Special Hazard Causes.

SINGEING. Number of fires, 40.
Sparks in goods from singeing process, 20 fires.
Sparks from singer in flock or lint pipe, 2 fires.
Sparks in cloth which had been singed the day before.
Sparks in hosiery which had been singed and piled on floor without being passed through the water bath.
Sparks in hosiery taken from singeing machine to storehouse.
Spontaneous ignition or sparks in cloth run through singer and piled on floor while hot.
Spark or burning piece of thread carried from singer to vat.
Opening in flue to coal-heated singeing machine overheated ceiling.
Sparks from singer ignited bonnet or tower over same.
Intense heat from plate-singer ignited woodwork in tower.
Excessive heat ignited lint on bonnet of oil-heated singeing machine.
Truck struck and broke fuel oil supply pipe to singeing machine.
Gas singeing machine. Drawing back of a spark or flame into gas supply pipe caused an explosion in gas meter.
Employees repairing defective gas singeing machine. Lantern ignited escaping gas.
Flame from fuel oil singeing machine ignited lint on machine.
Sparks from singer ignited woodwork.
Sparks from singer on roof.
Caused by singeing machine.
Unknown in singeing house or room, 2 fires.
SHEARING. Number of fires, 1.
Fire caused by friction in exhaust fan from shearer.
DYE MIXING AND CHEMICAL FIRES. Number of fires, 27.
Spontaneous ignition of chlorate of potash in a tub.
Chlorate of potash on floor ignited by barrel being rolled across floor.
Chlorate of potash ignited probably from friction.
Explosion of a cask of chlorate of potash.
Caused by chemicals in contact with chlorate of potash.
Explosion of chlorate of sodium while being dissolved in water.
Chlorate of sodium ignited from concussion.
Employee was opening a barrel of sodium chlorate when it exploded.
Unknown in a partially filled keg of chlorate of sodium.

Ignition of chlorate of sodium stored in color room.
Explosion of chlorate of sodium in bins in color room.
Sodium chlorate box ignited from unknown cause. Box had been in use for a year and was thoroughly saturated with the chlorate.
Concussion of chlorate of sodium.
Fire started in chlorate of sodium from unknown cause while stored in shed.
Unknown in empty kegs in basement of dye house. Kegs had contained either the chlorate of sodium or potash.
Fire caused from spontaneous ignition in a barrel of sodium sulphide.
Fire started near barrels where chemicals were mixed in dye making.
A batch of chemicals which had been mixed and allowed to stand, spontaneously heated and ignited.
Spontaneous ignition in a jar of black liquor mixed for dyeing.
Spontaneous ignition in a barrel of dye stuff, 2 fires.
Spontaneous ignition in one of the storage bins in drug room.
Spontaneous ignition in waste barrel in color room.
Spontaneous ignition in drug room.
Fire started in laboratory where chemist had just unpacked some chemical supplies.
Ignition of straw packing around a carboy of nitric acid.
Unknown chemical fire.

CLOTH PRINTING AND ROLL ETCHING. Number of fires, 6.

Printing roll etching and hardening, 4 fires.
Spontoneous ignition of nitric acid soaked lint which had collected under floor of roll etching room.
Ignition of oil and lint in pipe to fan supplying air to gas furnace in hardening room of engraving department.
Heat from furnace ignited lint on blower fan.
Gas furnace ignited lint which had collected on blower pipe.
Spontaneous ignition of gray cloth used as backing cloth on printing machine.
Unknown in cloth passing through printing machine.

STEAMING AND AGEING ROOMS. Number of fires, 7.

Cause unknown in steaming room but probably lint and oil in fan which exhausts steam from steam pressure boxes.
Overheated bearing on fan in steaming box of dryer.
Goods dyed aniline black were found about to ignite when taken from steaming box, due to the rapid oxidizing of the colors.
Spontaneous ignition of black lint and fly from goods in ageing box.
Overheated bearing on ventilating fan in ageing room.
Fan in the ventilating apparatus of the aniline agers struck fire.
Unknown in ager.

DRYING. Number of fires, 36.

Can dryers, 4 fires.
Ignition of overalls placed on dry can to dry.

Friction of fan in duct over can drying machines.
Unknown in fan over can dryer, 2 fires.
Tenter dryers, 3 fires.
Overheated bearing in blower box of tenter dryer.
Lint in fan box of tenter dryer ignited.
Ignition of lint inside of flue or overheating of flue of tenter dryer.
Yarn dryers, 4 fires.
Yarns against steam heating pipes of dryer.
Overheating of yarn dryer.
Unknown in yarn dryer, 2 fires.
Cell dryers, 2 fires.
Overheated bearing on fan in cell dryer.
Ignition of lint in ventilating duct over cell dryer.
Dry rooms, 9 fires.
Ignition of fly and lint on steam pipes in dry room
Overheated stove in drying room.
Unknown in hot air duct from dry room.
Steam pipe in contact with woodwork of dry room.
Overheated bearing on fan of white drying room.
Unknown in dry rooms, 4 fires.
Overheated bearing on fan of cyclone dryer.
Blade of fan in hurricane dryer broke, causing friction.
Friction of stock between beater and metal apron in Sargent dryer.
Overheated bearing on fan between dry boxes of dryer.
Cloth passes from printing machine through hot room, being dried before folding. Chain broke, allowing cloth to fall onto wire over heater.
Defective construction in hot room or tower from printing machines.
Friction in dryer.
Overheating of rag dry box.
Overheated bearing on dryer.
Unknown in dryers, 5 fires.

SPONTANEOUS IGNITION OF DYED GOODS. Number of fires, 23.

Spontaneous ignition of dyed goods in dry room or dryer, 4 fires.
Fire occurred in cloth passing from printing machine over can dryer.
Spontaneous ignition of dyed yarn which had been in dryer but six or eight minutes.
Spontaneous ignition of dyed yarns in dryer.
Spontaneous ignition of aniline dyed cloth while drying on racks over steam pipes.
Spontaneous ignition of black dyed goods.
Spontaneous ignition of light dress goods dyed logwood black.
Spontaneous ignition of rolls of goods dyed with logwood black and chrome.
Spontaneous ignition of goods dyed logwood black piled on floor.
Spontaneous ignition of goods during process of dyeing logwood black.
Spontaneous ignition of roll of goods dyed aniline black.

Spontaneous ignition of a roll of black dyed cloth which had been dried and piled on truck while warm.
Spontaneous ignition of black dyed cotton goods.
Spontaneous ignition of black dyed cloth, 2 fires.
Spontaneous ignition of black rags.
Spontaneous ignition of dyed hosiery taken from dryer and piled on floor. Ignition probably due to not being thoroughly dried.
Spontaneous ignition in a bag of dyed stock.
Spontaneous ignition of dyed goods piled on table in dry room.
Fire occurred in a large bin containing cotton yarns that had been dyed and dried.
Supposed spontaneous ignition of dyed yarns in storage.
Spontaneous ignition of dyed goods, 3 fires.

CLOTH NAPPING. Number of fires, 11.

Friction from cloth wound around fan bearing in dust flue from napper.
Foreign substance in fan caused sparks.
Overheated journal on fan in dust and lint flue.
Friction or overheated bearing in napping machine ignited lint or flock.
Foreign substance in cloth caused spark.
Fire was caused by sparks from napper.
Sparks from napper smouldering in napped goods.
Foreign substance accidently introduced into machine.
Caused from napper waste.
Hot journal in napper.
Lint from napper floated into gas jet, ignited and fell to floor, igniting lint and waste around machine.

MISCELLANEOUS FIRES. Number of fires, 13.

Friction in pulley in gray cloth chute from singer to kier.
Spontaneous ignition of wool that was being dried after a fire.
Explosion of gas oven for heating plates for plate pressing press.
Sparks from match on floor ignited gasolene vapors.
Benzine vapors ignited from unknown cause while treating silk.
Fire caused from friction or static electricity in silk being cleaned in naphtha washer.
Cast iron aniline waste pipe from mixing room passed through tenter dryer. Pipe leaked, causing spontaneous ignition.
Turpentine ignited, setting fire to woodwork of laboratory, cause not stated.
Unknown in ventilators in printing room.
Friction in fan in ventilating flue.
Heating of bearing on ventilating fan in printing room.
Friction in blower fan.
Spontaneous ignition in printers' blankets used to catch water from leak in attic.

Summary.

Common Causes.

	No. of Fires	Per Cent of Whole
Lighting	29	12.2
Heating	3	1.3
Power	11	4.6
Boiler (or fuel)	7	2.9
Rubbish (or sweepings)	6	2.5
Oily material	1	.4
Smoking	4	1.7
Lightning	5	2.1
Locomotive sparks	0	.0
Miscellaneous	8	3.4
Total	74	

Special Hazard Causes.

Singeing	40	16.8
Shearing	1	.4
Dye mixing and chemical fires	27	11.3
Cloth printing and roll etching	6	2.5
Steaming and ageing	7	2.9
Drying	36	15.1
Spontaneous ignition of dyed goods	23	9.7
Cloth napping	11	4.6
Miscellaneous	13	5.5
Total	164	

Common Causes	74	31
Special Hazard Causes	164	69
Total	238	
Incendiary	1	
Exposure	5	
Cause Unknown Fires	42	
Total Bleach, Dye, Print and Finishing Works Fires	286	

2. DETAILS OF CAUSES.

Common Causes.

H-6. Workman started to light a cigarette in the dye house. The head of the match broke off, falling into a pile of cotton, setting it on fire.

M-298. When power was turned off the night before, the rheostat arm failed to return to the "off" position. When the current was turned on the next morning, the excess current passing through rheostat ignited the insulation on the wires, sparks falling onto goods below and igniting them.

H-729. Boiler stack was without proper clearance and ventilation where passing through roof. Stack overheated, igniting roof of boiler house, fire also spreading into second story of bleachery.

H-993. Fire was caused by some bales of toweling piled against the steam heating pipes at wall.

H-1855. Fire was caused by a hot bearing on line shaft over dryers. This ignited flying on bearing which dropped onto dryer.

S-2232. Fire was caused by the breaking of arc lamp, the hot carbon falling onto rolls of cloth.

H-2909. Fire occurred in storehouse. Employee used a match in finding number on the outside of a bale of finished goods, igniting the burlap covering. Fire was extinguished with water pails.

H-4199. Fire occurred at 9 p. m. in a barrel half full of sweepings. Barrel was located only a few feet from singeing machine and it is possible that a spark was swept up with the fly around machine, igniting sweepings in barrel.

S-7426. Fire occurred in boiler room. The steam pipe at location of fire was wrapped with asbestos and then covered with a layer of sawdust and paste. Sawdust evidently ignited from overheating or spontaneous ignition.

S-8234. Employee only partly opened switch on electric light system at closing time. This caused switch to arc, which melted the copper contacts, the fused metal dropping onto and igniting cloth bales stored below.

S-9896. Blower people were installing a blower system to remove lint from napping department The employee underneath floor was using an electric lamp on a heavy insulated extension cord when a spark at lamp ignited lint and flyings.

Special Hazard Causes.

H-147. Fire apparently started from spontaneous ignition in the black fly and lint from goods in the ageing box in ageing building. Box was tin lined and fire was confined to the upper part of ager.

M-165. Fire occurred in the dye house during the day, starting among ninety pieces of aniline blacks which had been put through the steaming box. When taken out it was found that the chemical change had been so rapid that they were about to ignite. They were at once taken into

the soaping room and put through washers, and buckets of water were also thrown on the goods. The fumes were so strong as to drive the help from the building, and one was rendered unconscious. By very rapid and judicious work fifty pieces were saved without damage, but the remainder were thoroughly charred.

M-199. Fire occurred in the finishing building at 7 a. m., caused by spontaneous ignition of light dress goods dyed logwood black. Thirty-six rolls had been run through tentering machine and were lying on trucks. The workmen found that two of them were hot, and on looking further two more were found to be in the same condition. They were immediately taken to the yard and were found to be on fire at the centre.

M-209. Fire occurred at 11.40 p. m. in the dye house, caused by spontaneous ignition of dyed goods. It is supposed that some of the chemicals which were on the edges of "gray backs" were not thoroughly washed out and that the heat of drying affected these so as to cause them to ignite spontaneously.

M-230. Fire occurred at fuel oil furnace for heating singe plate. The flame forced out into room igniting lint on top of singe machine.

M-251. A back cloth which had been run on a pattern of steam colors was dried through padding room cans and sent to the steaming room winder. The odor of burning cloth was noticed by the watchman at 7 p. m., but an investigation failed to reveal fire. At 11 p. m. smoke was seen coming from the creel containing this cloth by the watchman, who put out the fire with a chemical extinguisher. The cause of the fire is unknown, the goods having gone through no processes which could have produced such an effect.

M-258. At 12.30 p. m. a keg of chlorate of sodium ignited while being emptied into the tank. The cause is said to be unknown, but was probably due to concussion, as chlorate of sodium is explosive under such conditions. Five sprinklers opened, and one hose stream was used in extinguishing the fire.

M-292. Fire was caused by a piece of metal coming in contact with the steel clothing of the nappers at about 5 p. m. The lint took fire and was blown into dust collector in yard.

H-2850. Fire occurred from unknown cause at 4. 30 p. m. in the hot room or drying enclosure above and connected to printing machine. The cloth coming from the printing machine passes up through the hot room or drying enclosure between coils of steam pipes heated to a high temperature, said to be 280° F., where it is thoroughly dried before passing to the folding machines. These hot rooms were about five by six feet in dimension, enclosed in frame yellow pine shafts, and extended from printing machines on first floor up through and into blind attic. The fire started at or near the top of the hot room, being discovered about an hour after steam had been shut off. If pipes had been in contact with woodwork this elapse of time would have allowed a drawing-away by contraction of the pipes, admitting air to the highly heated or carbonized surface of the wood. It may be

that the wood was in a condition susceptible to ignition without the close proximity of steam pipes, due to the continual heating to a high temperature and cooling; hot rooms being in service about seven years.

Building was originally erected for a shoe factory and the blind attic contained piles of leather dust which had not been removed when building was vacated by the shoe factory. It is possible that a leaky roof caused spontaneous ignition of this refuse; the former cause, however, appears the most probable.

H-3055. Fire occurred at 11.30 a. m. in the light open joist constructed shed occupied for the storage of cloth remnants in bales, chlorate of sodium, chorate of potash and old iron. Employee discovered fire in the end of shed where the chlorate of sodium was stored and before he could give alarm, almost instantly the whole shed was enveloped in flame. Fire was fought with private and public hose streams and confined to the building in which it occurred, but so rapid and intense was the spread of fire that entire contents of shed was destroyed and adjacent building badly damaged. Definite cause unknown, but attributed to chemicals stored in shed.

M-4540. At 4 p. m. an explosion occurred in the chemical department. All the chlorate of sodium was delivered in solution to the print works, the process being carried on in the chemical works by carefully opening a keg of chlorate and emptying it into the proper amount of warm water in a barrel on the second floor. After being stirred, the solution was drawn off into another barrel on the floor below, through a pipe screwed into the bottom of the upper barrel, the opening being closed by a long plug. The opening in the head of the lower barrel was closed by a wooden plug. After the barrel had been filled, the plug was put in as usual and was being driven tight by a blow from an old brass valve, when there was a slight explosion and flames shot up two or three feet. In the future new plugs will either be used or the old ones will be thoroughly washed before being used again. Wooden mallets will also be used.

S-4721. Fire was caused by a spark lodging in cloth while passing through plate singeing machine. A grade of cloth requiring singeing on both sides was in process; one side only having been singed, cloth could not be wet until completion of singeing. Fire was discovered during the second singeing and extinguished with water from a fire pail.

S-5243. Chlorate of sodium was being mixed with water for use in dyeing, when it suddenly exploded, burning one man and injuring several others. Sodium chlorate, or a similar chemical potassium chlorate, is always used in aniline black dye works. When mixed with organic substances or acids, or when handled too carelessly or roughly, it is liable to explode or take fire. The method of mixing this substance was as follows:—

Main supply of sodium chlorate was stored in fireproof vault in a detached building and consisted of about twenty-five kegs, each keg holding 70 pounds. One of these kegs was brought into bleach room and divided into two portions. The mixing was done in a large tank on

a platform. Over this tank were two wood barrels, one to contain the sodium chlorate solution and the other the aniline salt solution. Cold water was run into one of the barrels, and the first portion of sodium chlorate was poured into the water and stirred until dissolved. It was then drawn to the tank underneath and mixed with the aniline salt solution which is prepared similarly in the other barrel.

On the morning of the explosion, several batches had already been mixed and from fifteen to twenty pounds of the chlorate had been run into the barrel. While the men were pouring in the remainder, the whole thing exploded, blowing out the bottom of the barrel, the flash setting fire to the roof, and also operated two sprinklers, which practically put out the fire. The manager attributes the explosion to careless handling of the chlorate, throwing it against the sides of the barrel or producing friction. Any organic substance or acid if mixed with the chlorate might cause a similar explosion, or possibly the chlorate itself may not have been as pure as usual. While the careless handling of chlorate of sodium may produce an explosion, still it is more likely that the trouble was due to either impurities in the soda or to the presence of some acid or gas.

In speaking of chlorates (including lead, potassium and sodium), Dr. Von Schwartz says:—

"They explode with great violence when ground, pounded or warmed along with organic substances (sugar, flour, powdered fruits, spices, wood) or with carbon, phosphorus or powdered metals. Still more powerful explosions may be produced in association with potassium cyanide or thiocyanate, sulphides (iron or antimony sulphide), matches or firework charges.

"Chlorates are just as susceptible towards fats and oils, these readily allowing the chlorates to explode, and unless the most stringent precautions be taken to prevent oil or greasy rags, etc., being conveyed in any way to the chlorate plant from the engine or boiler house, or from the room where the lamps are filled, cleaned, etc., a most violent explosion may be produced at any time, possibly to the entire destruction of the works. As a means of precaution, oil lamps should be banished from chlorate works and all greasy rags, etc., burned at once.

"Explosions may also be produced in breaking lumps of chlorate that have dried hard. Should a few crystals of chlorate remain in the neck of a stoppered bottle and suffer attrition when the stopper is inserted, an explosion may be produced. Soft stoppers (rubber, wood, cork) alone should be used for chlorate bottles, and the rubber must be free from sulphur. Packing paper, millboard, etc., for chlorate packing should be made fireproof by impregnation. In the storerooms, etc., all possible precautions must be taken against the spread of fire, and the factory and store must be separated in a fireproof manner. Anything likely to produce sparks must be avoided, and all organic materials, even dust, must be excluded from the chance of admixture with chlorate, since the latter renders them very inflammable. Strong acids must be kept from

contact with chlorate or explosive gases like chlorine tetroxide will be formed."

H-5318. Fire occurred at 6.40 p. m. in a pile of stockings in singe room. Stockings had been run through singeing machine just before shutting down, and piled on floor without being run through the water bath after singeing on account of the light colored dyes used. Fire was probably caused by a spark from the singeing machine smouldering among the stockings, finally breaking out into blaze. Stockings were supposed to have been carefully examined before employees left building.

H-5427. Fire occurred in cotton flannel napping machine from unknown cause, but probably from foreign substance striking fire while passing through machine with cloth.

H-5454. The drying enclosure was of wooden construction, about forty feet long and eight feet high, divided into sections, each section being heated by steam pipes located on the side of each section or box. The yarn stock was run in on trucks. Fire occurred in one of these sections during the noon hour. Cause could not be determined, as the dense smoke forced employees from room. It may have been due to spontaneous ignition of the stock, accelerated by the pressing contact of the yarns under heat; or the yarns may have come in contact with the exposed steam heating pipes.

H-5811. This fire occurred in the drug and chemical house, a small wooden structure about seven feet high by eight feet long. The chemicals comprised chlorate of soda and potash, copper sulphate and sulphur black, in kegs and barrels. A batch of the salts had been mixed and allowed to stand in a barrel. During the temporary absence of the mixer the ingredients heated up, no doubt aided by the heated atmosphere of 90°, and ignited. Upon opening the door a violent blaze was in progress, and although a yard hose stream was quickly applied, the fire burned fiercely.

The firemen were summoned, arriving in time to prevent the fire from igniting the dye house proper, twenty feet away. The drug house and contents were destroyed.

This fire adds to a number occurring through ignorance of employees of the danger from the mixing of chemicals containing oxidizing substances and allowing the mass to stand for a long time, instead of dumping it in the dye tub of water.

S-6060. Brick flue or chimney from singeing machine extended up side wall to within about two feet of the metal-clad ceiling, where it passed through wall connecting with brick flue from boiler. After the fire it was found that the brick work on the top of the horizontal portion of flue had broken away, leaving an opening through which flames or heat reached ceiling and ignited ceiling in back of the metal covering.

S-6111. Fire occurred in room containing the dye stuffs and oils used in the plant, the floor being more or less oil-soaked. Only one small keg of chlorate of sodium was kept in the room at a time, some of

which had probably been dropped on floor when being removed from keg. The chlorate on the floor mixing with oils and other foreign matter readily ignited from friction. Three Grinnell glass disc sprinklers opened and four large hose streams were used, the fire being extinguished in about ten minutes. Fire spread under and around oil barrels, the contents of drip pans making good fuel.

S-6879. Fire occurred at 9.15 a. m. in the aniline dyeing department. An employee was opening a keg of sodium chlorate when it suddenly burst into flame, burning him fatally. Superintendent heard two explosions, and it is thought that another keg standing near by ignited. Nine sprinklers opened, extinguishing fire with assistance of private hose equipment.

S-6902. Watchman on entering dye house discovered that sprinklers had operated and extinguished a fire which started in a barrel of sodium sulphide from unknown cause.

S-7695. Fire occurred in the color room at 5.15 p. m., being discovered by employee. Superintendent gives cause as spontaneous ignition of chlorate of sodium stored in room with other chemicals. It is probable that employee either stepped on some chlorate on floor or that same came in contact with other chemicals in the room.

S-8896. Fire was caused by spontaneous ignition of some bundles of percaline dyed with logwood black. The goods had been in the pile for four or five days preparatory to starching. There was over ten thousand yards in the pile, about two-thirds of which was destroyed by being burned or made tender by the heat.

S-9468. Fire occurred from unknown cause in the metal hot air duct which conducts the heat from the roll drying room on second floor to the dye house about twenty-five feet distant, where it is utilized for heating the dye house. The roll drying room is used for drying knit goods. The goods are frequently knitted in long cylindrical pieces and washed and dried in the piece. The drying brings into use the roll-drying process, which consists of drawing the goods over a long metal cylinder through which heated air is blown. The goods drying on the cylinder are formed into a roll when delivered. Duct had been in service for about a year, and probably had quite an accumulation of dust and lint in it at the time of fire.

S.-9568. Fire was caused at 6 a. m., due to spontaneous heating of goods in process of dyeing logwood black.

S-10109. Fire was caused by a spark or burning thread end which was carried in the cloth to the vat where the stock was stored until the lot was singed. Fire smouldered throughout the night, being discovered the following morning when removing cloth from vat.

3. ROOMS IN WHICH FIRE OCCURRED.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Storage and non-manufacturing	14	23	9	6	13	33	36	15
Boiler and engine room	6	10	..	..	..	..	6	2
Singeing and shearing	2	3	36	24	1	3	39	16
Bleach house or room	..	..	2	1	..	..	2	1
Drug room and dye mixing	1	2	24	16	1	3	26	10
Dye house or room	7	12	8	5	5	13	20	8
Printing roll making	..	..	4	3	1	3	5	2
Printing room	6	10	4	3	1	3	11	4
Dry room or house	7	12	42	28	8	20	57	23
Steaming and ageing	2	3	5	3	..	..	7	3
Napping	4	7	5	3	..	..	9	4
Finishing	9	15	7	5	6	15	22	9
Miscellaneous rooms	2	3	3	2	3	8	8	3
Total with data given	60		149		39		248	
No data	14		15		9		38	
Total	74		164		48		286	

4. DAY OR NIGHT FIRES. (Day Fires 6 a. m. to 6 p. m.)

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Day	48	69	89	59	23	51	160	60
Night	22	31	62	41	22	49	106	40
Total with data given	70		151		45		266	
No data	4		13		3		20	
Total	74		164		48		286	

5. PLANT IN OPERATION.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Plant in operation .	15	65	50	68	11	55	76	65
Plant not in operation	8	35	24	32	9	45	41	35
Total with data given	23		74		20		117	
No data	51		90		28		169	
Total	74		164		48		286	

6. HOW DISCOVERED.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Employee	17	65	48	62	13	50	78	60
Watchman	6	23	22	29	7	27	35	27
Thermostat	..	..	..	..	..	..	..	..
Sprinkler Alarm .	1	4	..	..	..	..	1	1
Outsider	2	8	7	9	6	23	15	12
Total with data given	26		77		26		129	
No data	48		87		22		157	
Total	74		164		48		286	

SPRINKLER FIRE RECORD.

7. EFFECT OF SPRINKLERS.

	No. of Fires.	Per Cent of Whole
Extinguished or practically extinguished fire	59	53
Held fire in check	47	42
Unsatisfactory	6	5
Total	112	
No claim	22	20
Small loss	84	75
Large loss	6	5
Total	112	

8. DETAILS OF UNSATISFACTORY SPRINKLER FIRES.

8086. July 9, 1893. Fire started at 2.30 p. m. in the bleachery, caused by spontaneous ignition in a bundle of black rags stored on the timber trusses. Fire was discovered by watchman, who gave alarm. The buildings were equipped with New Haven automatic sprinklers, supplied by a pump, the 5,000 gallon tank being in position but not connected. The smoke forced the employees to abandon the hydrants, they also proving very inefficient in handling the fire. Loss total; $90,217.

Summary: Deficient water supply. Poor arrangement of hydrants.

1555. September 22, 1901. Fire was caused by sparks left in goods after passing through gas singer, breaking out into flames at 12.30 p. m. Singe room was located over boiler room on the third or top floor, roof being of joist construction with a skylight four and one-half by seven, which contained an open ventilator about fifteen inches square.

Building was equipped with John Kane Universal, William Kane bulb and William Kane skeleton or No. 3 sprinkler heads, the room in which fire occurred being equipped with the latter, installed about twelve years previous to fire. There were fourteen heads in room supplied by a two-inch riser. Water supply was from a gravity tank giving about eleven pounds pressure. Secondary supply was from a fire pump.

About a bale of cotton goods for shirtings had been singed in the morning, and as the owner was to call at noon for goods, they were not continued in process and cooled, but were allowed to run into a pile on the floor. Engineer smelled smoke and discovered fire, attempting to extinguish it with fire pails. Not being successful, he gave alarm, finally extinguishing fire with fire pails, with the assistance of employees.

No sprinkler heads opened. The pile of stock was mostly consumed, two trucks and a bench burned, also a hole about four by five burned through the floor, showing considerable fire. The solder on one sprinkler head directly above melted, struts releasing, but the head failed to open, the seat evidently being corroded sufficiently to hold to orifice. Had fire pump been used on sprinklers under heavy pressure, this sprinkler would probably have operated. Equipment was old style and poorly arranged. Loss about $300.

Summary: Defective sprinklers.

3107. July 25, 1904. Fire occurred from unknown cause in the dry can room at 11.30 p. m. and was first noticed by an outsider, the watchman discovering it soon after. There was no record that watchman made his rounds properly, as watchclock and records were destroyed in the fire.

Dry can building was one story in height, frame open joist construction, equipped with Grinnell glass disc 286° sprinklers, the primary supply being from a 5,000 gallon gravity tank giving fifteen pounds pressure on sprinklers first opened. Second supply was from a small steam pump which had been in poor condition for a long time. A new pump had been purchased and was awaiting installation. Pump was

supposed to be automatic, and it is stated that it was used; but after a few minutes the roof of can dryer building collapsed, breaking the main steam pipe passing through main mill and crippling this supply.

Soon after fire was discovered it had spread throughout the can dry room and to the main mill, buildings being practically a total loss. Owing to the failure of the fire pump there was no outside protection, works being in the country without fire department protection.

It was not definitely determined that any water came from the sprinklers, but all of the valves were found open after the fire. The most plausible theory for the unsatisfactory work of the sprinklers to hold the fire in check seems to be, that the sprinklers were high test and may have been slow in operation, which, together with the light pressure from the tank, allowed the fire to spread. It is evident that after a number of heads opened the tank was of little use even if in service, and there being no proper pump supply to supplant the tank, the sprinklers did not have an adequate supply of water.

High test heads should not be used unless absolutely necessary, and when necessary the section where they are located should be cut off by standard fire wall, in order to give good protection. Loss large.

Summary: High degree sprinkler heads.

3951. January 31, 1905. Fire occurred in the singe house at 6.30 p. m., being discovered and alarm given by watchman. The cause of fire was somewhat obscure, but was probably from the intense heat from the plate singer charring and igniting the woodwork in the tower back of the tin lining, fire burning slowly for sometime before breaking out.

Singe house and tower were eqipped with Grinnell glass disc sprinklers, six of which opened. Sprinklers, however, were shut off on account of cold weather and were of no value. Fire was extinguished by private and public hose streams with a loss of approximately $300.

Summary: Water shut off on account of cold weather.

7974. October 16, 1908. Fire started in frame building containing dryer and dyeing machine, probably starting in dryer. Plant was in operation, and there were three employees in the building at the time. This building was equipped with sprinklers which, however, did not hold the fire in check, as the dryer and roof were burned. Fire was finally controlled by hose streams. It is not known whether system was in service or not.

Summary: Not classified.

8089. December 21, 1908. Old frame building occupied for dyeing and finishing hosiery. Fire started on outside of building, supposedly from sparks from boiler lodging in rubbish on the river side of plant. This part of the building was inaccessible to hose streams and fire was beyond control by the time it reached the sprinklers. Building was equipped with Grinnell glass disc heads, a modern equipment, supplied by a 25,000 gallon gravity tank, which also supplied the hydrants. Building was practically a total loss.

Summary: Exposure fire.

9. DETAILS OF LARGE LOSS SPRINKLER FIRES. (Where sprinkler control was satisfactory.)

1466. February 19, 1896. Fire occurred about 7.30 in the morning in the first story of the two-story brick detached building known as the drug house. In this first story was stored, among other things, about thirty-five small casks filled with chlorate of potash. The men were moving these casks about and packing them up against the side walls of the buildings. As one of the men was about to place one of these wooden casks in position, it exploded, blowing out the bottom and immediately setting fire to the other casks. A series of explosions followed and the men had barely time to get out of the building.

Both the public alarm box and the private alarm were immediately rung in and the private department had several streams of water on the fire before the city department arrived.

The building was equipped with Grinnell glass disc sprinklers, which at the time of fire were supplied with city water under a pressure of about sixty-five pounds. Every one of the sprinklers in the building, some fifty-two in all, opened, and did efficient service. As soon as the steamers began draughting from the city mains, it is very probable that the pressure was decreased, but from all accounts the sprinklers seemed to have continued to do good service until the fire was entirely extinguished, which was about one hour after it started.

There was a 750 gallon steam pump which served to supply a private hydrant system, and also could be used as a second supply to sprinklers. The pump pressure was not, however, put on the sprinklers, but was used for hydrant service only. It is a question whether the sprinklers would not have given better service if the heavy pressure from the pump had been put on at once, but the arrangements of pipes and valves at this risk was such that it was necessary to close a valve in the street connection before the pump pressure could be put on the sprinklers.

It is a difficult matter to determine the exact cause of the fire. Chlorate of potash when mixed with organic compounds has explosive properties, and it may be that the explosion was due to some impurities in this particular lot. The workman states that the explosion occurred just as he was about to set the cask, which he had in his hands, on another cask. Owners have had no previous trouble of this nature and will in the future store the potash in an out-building away from all other buildings. The chlorate of potash is used in a process of dyeing aniline black. The aniline color is in a liquid form, and the potash in solution is added. Fires have been known to occur from the callender rolls over which the cloth passes after being dyed, for when the rolls are scraped the friction will set fire to the crystallized particles of potash which adhere to the rolls. These fires, however, have only been known to occur when the scraping was done before the rolls had cooled.

In both of the first and second stories of the building was stored a large amount of chemicals and dye stuffs to the value of nearly $30,000.

With the exception of the destruction of the chlorate of potash, and a slight burning of the ceiling, there was practically no direct fire loss, but there was a loss of some $15,000 water damage to the stock of dye stuffs.

Summary: Severe hazard.

958. May 4, 1900. Fire was discovered by watchman at 6.40 a. m. around the blower used for the hot air system of dry room. Cause of fire unknown, as heat in dry room had been turned off for three hours or more previous to fire. Dry room was located on the top floor, built at one side of the building; was about seven feet high with a tight wooden constructed ceiling. Blower was partly enclosed with wood, covered with sheet iron.

This room was equipped with Grinnell glass disc sprinklers on wet system, 1-2-4 schedule of pipe sizes, supplied from city waterworks giving 98 pounds pressure on sprinklers first opened.

Upon discovery of fire, watchman immediately gave alarm and fire department arrived promptly, using two hose streams. Sprinklers were in operation at this time and were holding fire in check. The fire starting near the blower, warped the sheet-iron covering and spread into the ceiling of dry room; also igniting yarn in process of drying, opening fourteen heads in dry room and four over dry room. Fire was finally extinguished by sprinklers and hose streams. Loss approximately $7,000; being mainly from water, due to the number of sprinklers opened.

Summary: Concealed space, faulty construction.

4453. December 1, 1905. The night of the fire forty trucks containing gray singed cloth stood in the south end of the bleach room. The sprinklers had been removed from this end of the room on account of corroded condition of pipes and heads, consequently when fire started in the cloth there was nothing to check it and it quickly spread over all the trucks and also burned the upper portion of the cloth in the vats. This indicates the intensity of the heat, as the cloth in the vats was wet. The trucks having no sides or ends, all the cloth was burned on four sides and top of each pile.

The fire passed up an elevator to a small room in second story full of cloth, and this also was burned. The beams, posts, and plank floor overhead were badly burned and had to be renewed or sheathed. The windows were destroyed. Ten minutes after the fire started the flame was coming out of these windows and extending up to second story on the outside. Three standard tin-clad fire doors prevented the fire from entering the adjoining rooms, and these doors, although exposed to great heat, were still in place and retained their shape.

Rooms adjoining were equipped with Grinnell glass disc and Hill sprinklers on wet system, supplied from public mains giving a pressure of 100 pounds.

Twelve sprinklers opened in the napping room directly over the fire, twenty-one in kier room, three in singe room, and one in back napping room. The water from these heads surrounded the bleach room, in which fire was burning, and prevented its spread and a much larger loss.

Four hose streams were taken from yard hydrants and three from hydrants in the street, and the fire was fought through the windows on the west side of the building. Loss approximately $14,000.

Summary: Defective equipment.

10. POINTS OF INTEREST FROM FIRE REPORTS.

Alarm Service.

S-904. Watchman smelled smoke on his eleven o'clock p. m. round, but could not locate fire. Completing his round, he returned over route and located fire in the top floor of main building in the gray room.

S-10041. Fire occurred Saturday afternoon, being discovered and alarm given by employees cleaning up room. Watchman service covers nights and days when not running, with the exception of Saturday afternoon.

Automatic Sprinklers.

M-217. Fire started in rag drying box. One sprinkler inside the box would have extinguished the fire. The fire extending up the side of room passed through cracks in the floor to room above. It also spread to the printing room, damaging a large temporary electric switchboard and a thousand-light transformer. Seventeen sprinklers opened and extinguished fire, assisted by two hose streams.

M-289. Dry can building was equipped with Newton automatic sprinklers, four of which opened. The remainder were of no service, failing to open and allowing fire to burn over about two-thirds of the walls and the ceiling.

M-292. Temporary dust collector in yard was equipped with two sprinklers, but these had been shut off for the winter. The building was destroyed by the fire and proved a severe exposure to other buildings.

S-6748. Fire occurred in the ventilating hood over can dryers, spreading to a small monitor. There were no sprinklers inside the hood, and before hose streams could be brought hood was thoroughly afire. Six sprinklers opened over the hood and prevented the fire from spreading except into the monitor. The monitor and hood were destroyed.

Fire Doors.

S-4453. Sprinklers had been removed from room in which fire occurred. Three standard fire doors prevented fire from entering adjoining rooms. These were exposed to intense heat but were still in place and in shape after fire.

H-5500. Storehouse in which fire occurred was one hundred by fifty feet in area, constructed of brick walls with wooden roof and well cut off from dye house and drying rooms by automatic fire doors. These doors were open at the time of fire but closed automatically, confining fire to the storehouse.

Private Protection.

H-1855. At the time fire was discovered by employee at dryer, it could easily have been extinguished with a pail of water. There were no fire pails in this room and an attempt was made to use mill hose. This was not long enough to reach second floor. Before another length could be secured and coupled on, fire had gained great headway, quickly spreading through all of the second floor.

H-5318. Fire was extinguished by watchman and member of firm with chemical extinguishers and private hose on connection in adjoining room with but slight loss.

H-5454. Yarn dryer was equipped with steam jets which operated but without perceivable results. This may be accounted for by the ventilators on top of dryer which allowed the rapid escape of the steam.

S-9896. Employees did excellent work extinguishing fire before sprinklers opened, ten chemical extinguishers and one private yard hose stream being used.

Unprotected Openings.

S-4114. Fire occurred in the two-story brick joist constructed building occupied for dyeing; building not equipped with sprinklers, but communicating with the sprinklered building through two large unprotected doorways and two belt holes. Heat passing through these openings opened forty-eight sprinklers in the sprinklered building which, with the assistance of hose streams, prevented fire from entering.

11. NUMBER OF SPRINKLERS OPENED.

No. of Sprinklers Operating.	Extinguished Fire. No. of Fires.	Extinguished Fire. Per Cent.	Held Fire in Check. No. of Fires.	Held Fire in Check. Per Cent.	Unsatisfactory. No. of Fires.	Total. No. of Fires.	Total. Per Cent.	No. of Sprinklers Operating.	No. of Fires.	Per Cent of Whole
1	20	34	5	11	..	25	23	1	25	23
2	12	20	3	6	..	15	14	2 or less	40	36
3	6	10	3	6	..	9	8	3 or less	49	45
4	3	5	1	2	..	4	4	4 or less	53	48
5	3	5	3	6	..	6	5	5 or less	59	54
6 to 9 inc.	8	14	10	21	..	18	16	Less than 10	77	70
10 to 24 inc.	4	7	16	34	..	20	18	Less than 25	97	88
25 to 49 inc.	3	5	4	9	2	9	8	Less than 50	106	96
50 and over	..	..	2	4	2	4	4	50 and over	4	4
Total	59		47		4	110				

Average number of sprinklers opened, not including unsatisfactory, 9.0.

12. ALARM SERVICE.

	Satisfactory.		Failure.		Total.
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	
Watchman alone	22	96	1	4	23
Sprinkler alarm alone	1	100	..	..	1

	Watchman.		Sprinkler Alarm.		Thermostat.		Supervisory.		Total.
	Satisfactory.	Failure.	Satisfactory.	Failure.	Satisfactory.	Failure.	Satisfactory.	Failure.	
Watchman and sprinkler alarm	1	..	1	..	..	..	..	..	1

Note.—These tables do not include fires where alarm service does or does not operate properly if fire is at once discovered by employee, the alarm service having no bearing on such fires one way or the other.

13. SECONDARY WATER SUPPLIES.

3054. Primary water supply was from gravity tank giving eighteen pounds pressure. Secondary supply was from fire pump. Twelve sprinklers opened and fire pump was put in operation, increasing pressure to sixty pounds.

5950. Primary water supply was from gravity tank, secondary water supply from steam fire pump. Sixteen sprinklers opened and fire pump was in service for about half an hour, assisting in the extinguishment of the fire.

14. EFFICIENCY OF WATER SUPPLIES TO SPRINKLER SYSTEMS.

Primary Water Supply.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
					Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Waterworks,	40	62	77	10.5	48	52	..	83	73	..	5.4	15.1
Gravity tank,	21	32	23	13.7	43	43	14	25	23	16	12.9	14.6
Pressure tank,	..	..	..	..	..	..	..	..	..	..	..	..
Automatic pump,	4	6	81	4.8	75	25	..	71	110	..	2.0	13.1
Total,	65		60	11.1	47	47	5	65	59	16	7.3	14.9

15. EFFICIENCY OF WATER PRESSURES ON SPRINKLER SYSTEMS.

Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
					Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Less than 15 lbs.,	5	8	9	17.5	40	40	20	7	9	14	3.0	32.0
15 to 24 inclusive,	9	14	18	7.1	22	56	22	19	18	17	7.0	7.2
25 to 49 inclusive,	12	18	37	14.2	58	42	..	37	36	..	14.7	13.6
50 and over,	39	60	83	10.2	51	49	..	85	81	..	5.1	15.5
Total,	65		60	11.1	47	47	5	65	59	16	7.3	14.9

16. EFFICIENCY OF WET OR DRY SPRINKLER SYSTEMS.

Wet or Dry System.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
					Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Wet system,	64	98	60	11.1	48	47	5	66	60	16	7.3	15.2
Dry system,	1	2	21	6.0	..	100	..	..	21	..	..	6.0
Total,	65		60	11.1	47	47	5	65	59	16	7.3	14.9

Note—"Average number of sprinklers opened" does not in any case include the Unsatisfactory fires.

17. EFFICIENCY OF WATER SUPPLIES TO SPRINKLER SYSTEMS —As Regards Amount of Loss.

Primary Water Supply.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Waterworks,	40	62	77	10.5	7	85	7	92	75	88	6.6	8.6	35.6
Gravity tank,	21	32	23	13.7	19	71	9	22	26	15	6.2	17.1	..
Pressure tank,	..	..	..	..	..	..	..	..	..	..	..	..	..
Automatic pump,	4	6	81	4.8	..	100	..	..	81	..	..	4.8	..
Total,	65		60	11.1	11	81	8	52	61	58	6.4	10.3	35.6

18. EFFICIENCY OF WATER PRESSURES ON SPRINKLER SYSTEMS —As Regards Amount of Loss.

Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Less than 15 lbs.,	5	8	9	17.5	20	60	20	9	7	14	2.0	22.6	..
15 to 24 inclusive,	9	14	18	7.1	11	78	11	18	22	15	5.0	9.0	..
25 to 49 inclusive,	12	18	37	14.2	17	83	..	30	38	..	9.0	15.3	..
50 and over,	39	60	83	10.2	8	85	8	93	82	88	6.6	8.2	35.6
Total,	65		60	11.1	11	81	8	52	61	58	6.4	10.3	35.6

19. EFFICIENCY OF WET OR DRY SPRINKLER SYSTEMS. —As Regards Amount of Loss.

Wet or Dry System.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Wet system,	64	98	60	11.1	11	80	8	52	62	58	6.4	10.3	35.6
Dry system,	1	2	21	6.	..	100	..	..	21	..	..	6.	..
Total,	65		60	11.1	11	81	8	52	61	58	6.4	10.3	35.6

Note—"Average number of sprinklers opened" does not in any case include the Unsatisfactory fires.

Christmas Holiday Fires.

(Special Record.)

The following fires and casualties occurred **during the holidays just past.** They have been hastily gleaned with the help of our principal correspondents and cover but a few points in the United States. They indicate that the total fatalities among children at Christmas time may be very great.

Boy and a visitor at school were **slightly burned** when the Santa Claus costume worn by the boy caught fire from candle. A Christmas exhibition was being given at the school, and boy's costume was trimmed with **cotton batting.**

Hotel bell boy was **slightly burned** through the ignition of false whiskers which were set on fire by a candle while he was enacting Santa Claus.

While acting as Santa Claus a man was **seriously burned** about the face and hands through the ignition of his costume.

Mother was **fatally burned** while acting the part of Santa Claus for her little child. The inflammable false beard she was wearing was ignited by a candle.

A scholar was **fatally burned** due to her clothes catching fire from a candle on the school Christmas tree.

A little girl was **fatally burned,** her clothing catching fire from a lighted candle on the school Christmas tree.

While playing with a lighted candle in a "make believe" Christmas, a little child was **fatally burned.**

Christmas toy **proved fatal** to little boy. The child used a candle to heat his toy engine, accidentally setting fire to his clothing.

Fire was caused by a toy motion picture machine. The film while being exhibited flapped over onto top of lamp and ignited.

Children ignited the cotton decorations, used to represent snow, around Christmas tree. Tree was consumed and fire spread throughout the first floor. Members of the family were **seriously burned** in trying to extinguish the fire.

The floor about the Christmas tree was covered with cotton and was instantly in blaze when a lighted candle dropped onto same. Before two little children could run to safety their clothing ignited and they were **seriously burned.**

The Christmas tree was ignited by a lighted candle. The children escaped in safety. The interior of the room was badly burned.

Christmas tree was decorated with candles and paper novelties. Children in lighting candles ignited the combustible decorations.

A cat upset Christmas tree, which ignited from the candles, causing a loss of $100.

Lighted candle set fire to the Christmas tree. Tree blazed up, igniting woodwork of room, causing a slight loss.

Fire occurred while lighting gasolene lamps in a church. The Christmas decorations were ignited, causing much damage to walls, carpet, etc.

Gas jet set fire to Christmas decorations.

Fire was due to Christmas decorations.

A lighted candle ignited Christmas decorations in the show windows of a hardware store.

Mercantile. Fire rapidly spread over store, due to the holly, mistletoe and smilax wreaths and decorations, causing its partial destruction. Cause of fire unknown.

The most serious fire due to Christmas decorations occurred in a large mercantile store. Store was profusely decorated with evergreen boughs and festoons, which were thought to have ignited from defective electric light wiring. The inflammable decorations spread fire so rapidly and burned so fiercely that department was unable to cope with it. Building and contents were a total loss. Loss $212,154. Fire occurred at night with only the watchman at store. **Had fire occurred during the daytime another holocaust would probably have taken place.**

Forty-one additional fires were reported in dwellings caused from Christmas trees. Owing to lack of data these cannot be given in full. The cause with few exceptions is given as lighted candle igniting tree or decorations.

Unsatisfactory or Serious Fires in Buildings Equipped with Sprinklers.

Where sprinklers fail the cause is, almost invariably, clear. These fires are selected to indicate such causes, that they may be generally understood and satisfactorily met.

10361. June 5, 1910. Cotton Warehouse. Warehouse in which fire occurred was one story high, 50 by 100 feet in area, of standard construction, brick sides with frame ends and plank roof, and containing at time of fire 441 bales of cotton piled six bales deep, and miscellaneous storage. Night watchman heard the sprinkler alarm at 2 a. m. and investigating found fire burning among the bales of cotton. The definite cause of fire is unknown but was probably due to foreign material in the bales.

Building was equipped with Grinnell glass disc sprinklers installed in 1904. Pipes were installed in 1900 and were of the 1-2-4 schedule of sizes. Dry system was controlled by a Grinnell differential dry valve and was badly overloaded, there being about 500 heads on the one valve supplied by four long four-inch and one six-inch branch pipes. Fire burned almost through the two-inch plank roof in the corner where fire started, undoubtedly due to the slow operation of the dry valve. The primary water supply to sprinklers was from a gravity tank giving 45 pounds pressure. Secondary supply was from two 1,000 gallon fire pumps. These were immediately started and run for about one and a half hours. All the 60 sprinklers in warehouse opened but were severely handicapped, first by the slow operation of dry system and, secondly, by the obstruction to distribution due to the deep piling of the loosely packed bales, fire spreading under and between bales where water from sprinklers could not reach it. Loss approximately $4,500.

Summary: Obstruction to distribution.

10465. September 24, 1910. Bakery. Fire occurred at 10.04 p. m. caused by the chimney from the bake oven becoming clogged with soot. When the clean-out plate on the front of the oven was removed, heat and flames were forced into the room by the back draught, slightly charring floor joists and bridging nearby.

Building was four stories and basement in height, of brick walls, and heavy joist construction, fire occurring on the second floor. Sprinklers were of the Manufacturers "B" (1896) type, installed with pipes in 1904;

pipe sizes were the 1-2-3 schedule; wet system. There were about 100 sprinklers in the room, none of which opened. Fire was extinguished by chemical extinguishers. After the fire nine of these sprinkler heads, which were directly in the fire zone, were removed and tested, eight failing to open during the test. The heads showed very little or no corrosion, although they were more or less coated with the gummy dirt prevalent in this class of manufactory. Loss slight.

Summary: Defective sprinklers.

10355. October 17, 1910. Woolen Mill. Mill buildings were from one to three and a half stories in height, of frame construction, part sheathed, part plastered and ceiled, and seriously exposing one another.

Fire occurred at about 6.25 p. m. either on the first floor or attic of the old office ell adjoining main building. Cause is unknown, but it is thought that fire started from the carelessness of an employee in lighting his pipe and throwing down the match when leaving at closing time. Fire was discovered and alarm given by employees. The public fire department, one and a half miles distant, was called by telephone but did not arrive in time to be of much assistance.

Buildings were equipped with Grinnell glass disc sprinklers installed with pipes since 1896. Pipe sizes were the 1-2-4 schedule, spacing and arrangement of sprinklers standard of 1896. Sprinklers were on the wet system, primary water supply from a 4,500 gallon gravity tank giving about twenty pounds pressure on sprinklers first opened. Secondary water supply was a rotary fire pump, but this was not a factor in this fire as no one present knew how to operate it. About 90 sprinkler heads in the section where fire started are said to have operated, eventually followed by all heads in the several buildings. The main plant and group of buildings nearby were destroyed.

The fire starting in the one and a half story ell spread into the concealed space back of sheathing, up through roof, attacking the three and a half story main mill on the outside. In the early stages of the fire, employees tried to extinguish the fire inside of building with pails of water, while others were trying to start the fire pump. There was a good supply of these pails inside of the building, but employees could not locate them in the smoke and confusion and they proved of but little value. Owner had just left the plant at time of fire and there was no one familiar with the operation of rotary pump, so that same could not be started. This placed the entire hose service out of commission and the fire on the outside of the building could not be extinguished. The sprinklers inside of mill operated and were probably of assistance in checking fire until the limited water supply of gravity tank was exhausted. Main gate valve under tank controlling water supply was found open after fire.

The fire and apparatus was poorly managed. There was no one in authority on the premises to take command except an Italian watchman, who speaks only broken English, and the employees living nearby who had

not been instructed regarding the use of the private protection equipment. The defects of sheathed joist construction, lack of cut-offs and ignorance of employees in handling of fire apparatus was very marked. The fire could probably have been controlled at the start had someone familiar with fire pump and management of hose streams been in charge. Loss large.

Summary: Not classified.

10356. October 18, 1910. Woolen Mill. Fire was caused at 3 p. m., by foreign substance passing through card in card room on the second floor of main mill building. This section of the mill was three stories and basement in height of frame mill and joist construction partly sheathed and with stairways partly open.

Building was equipped with Grinnell glass disc sprinklers recently installed, replacing unapproved heads. There were about 96 in card room, all of which opened. Pipes were installed about 1886 and since, sizes standard previous to 1896, or the 1-3-6 schedule. Spacing of sprinkler heads was excessive across joists, up to twelve feet and not staggered. Sprinklers were on a wet system, primary water supply from waterworks giving from 70 to 75 pounds pressure on sprinklers first opened. Secondary supply was from a small belt driven plunger pump of 100 gallons capacity. This was apparently of but little value.

Fire was discovered and alarm given by employees, public department responding at once. The fire spread with great rapidity through the card room, due to the class of stock in process, aided by a moderate wind, the windows of card room being open. So rapidly did fire spread that several employees were forced to jump from the windows to escape from the flames. There were no cut-offs and chief of fire department states that building appeared to be doomed ten minutes after alarm was given.

Both mill and public apparatus were immediately placed in service, four hose streams being used on mill and three to five on adjacent exposures. These were supplied by steamer, town waterworks and neighboring mill pumps. The town water main at this point was but six inches and the water supply proved inadequate, due to the excessive number of hose streams and the large number of sprinklers in operation supplied through the four-inch sprinkler connection from town main. The sprinklers at first appeared to check the fire in the center of the building, but only for a short time, fire then rapidly spreading to the top floor through open stairs, hand hoist in stair tower, also spreading in back of the sheathing of walls. By this time, the large number of sprinklers opened, with the excessive number of hose streams in service had so greatly reduced the water pressure that but feeble hose streams were available. Firemen then devoted their energies to protecting the detached storehouse and finishing buildings and other exposures. Fire destroyed the main buildings and additions. Loss large.

Summary: Deficient water supplies.

9275. October 27, 1910. Carpet Yarn Mill. Fire occurred on the fourth floor of picker house at 11.30 a. m., caused by a piece of metal passing through finishing picker with the stock. Fire was discovered and alarm given by employees. The four-story picker house adjoined and communicated with the five-story main mill building, opening on fourth floor of picker house where fire occurred being protected with a single automatic tin-clad fire door. Buildings were of ordinary brick and stone construction, floors mainly two-inch plank, roofs board covered with composition roofing.

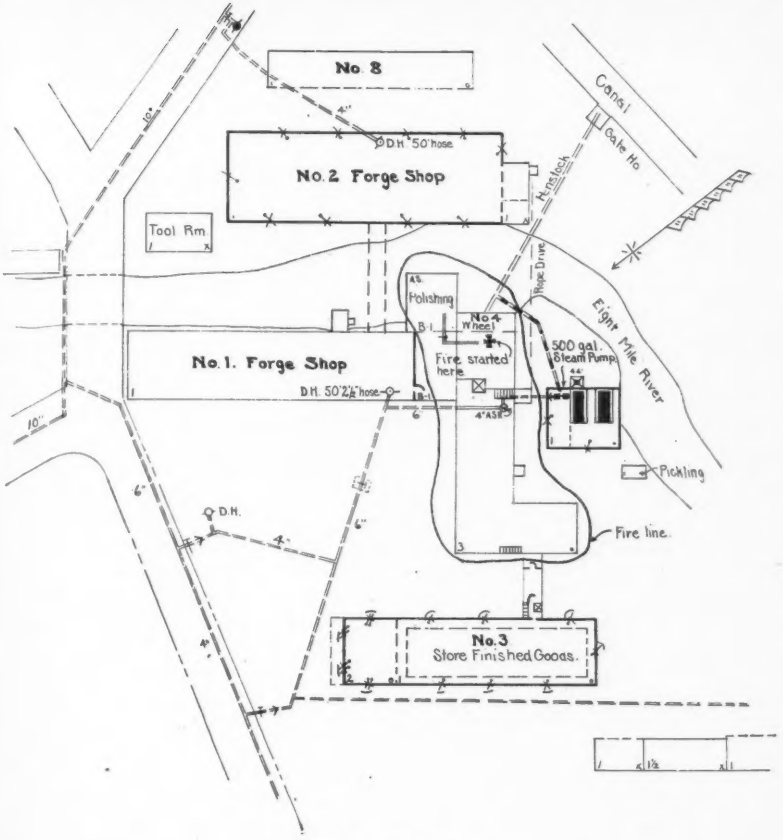
Buildings were equipped with Kane Universal and International sprinklers, mainly the former, installed with pipes about 1901; wet system, modern pipe sizes and spacing of sprinklers; primary water supply from waterworks giving from 80 to 85 pounds static pressure with a rotary pump as secondary supply. The rotary pump was not a factor in extinguishing fire.

The door of picker discharge box was open at time of fire and fire quickly spread over the stock on floor and in machines. Employees attempted to extinguished fire with chemical extinguishers but were forced from the room, leaving by way of the fire door. This fire door had been closed at start of fire and in opening or closing same it became wedged open, remaining open during the fire. Fire did not spread through this opening, being held in check by sprinklers in card room and chemical extinguishers. Thirty-three sprinklers in all opened, nineteen in picker room and fourteen in card room.

Fire caused considerable damage in the picker room and showed clearly that the sprinkler protection was greatly impaired. The roof planks were charred one-half inch or more, as were also the wooden columns. The pickers and willows were badly damaged and the window frames were burned out. The nineteen sprinklers in picker room were fed by a three-inch riser controlled on the fourth floor by an old style non-indicator valve with inside screw to which a stem or rod about ten feet long had been clamped so that valve could be closed from a point near the fire door. After fire this stem and hanger were found on the floor, the ceiling having been charred deeply enough to release the screws in hanger and the weight of the rod had broken the stem of valve near the valve wheel. This valve was found to have been only one-eighth open at time of fire. This reduced the supply of water to the sprinklers to a point entirely inadequate for protection and allowed fire to get beyond sprinkler control in picker room. It is not known how long valve had been in this condition, as valve was of the non-indicating type, so that its condition would not have been detected except by trial.

The loss of approximately $21,000 was mainly due to the inability of fire department to reach seat of fire except through card room and other buildings, causing much water damage.

Summary: Water shut off, unknown reason.



Fire No. S-7271.

7271. October 31, 1910. Machine and Forge Shop. Fire originated from unknown cause at 8.40 p. m., in the one-story and basement frame open joist constructed addition to rear wing of main building. All buildings in the fire area were of frame construction, one and three stories in height, adjoining and communicating, not cut off and with open stairways and elevator well. The frame addition in which fire started extended past the brick wall between rear wing and forge shop No. 1, greatly impairing its effectiveness. Frame addition was occupied for grinding and polishing.

The portion of plant destroyed was only partially equipped with sprinklers. The basement of addition in which fire started was unsprinkled, as was also the basement of rear wing into which fire first spread. Sprin-

klered sections were equipped with Grinnell glass disc sprinklers installed previous to 1908. Pipe sizes were the 1-3-6 standard, with the exception of those in addition which were the 1-2-4 standard. Spacing and arrangement of sprinklers was eight and ten feet apart parallel with joist by eight feet across joists, not staggered. Sprinklers were on the wet system supplied by waterworks, eighty-five pounds pressure as a primary supply and a 500 gallon steam pump as secondary supply.

Fire starting in the unsprinklered basement of addition spread quickly into the unsprinklered basement of rear wing, up open stairway and open elevator shaft of main building, spreading laterally on each floor, especially in the attic, which was occupied as a carpenter shop and for storage of small wooden boxes.

Fire was first discovered by an outsider, who notified watchman to blow mill whistle and then rang in public alarm. Watchman's records show that he started his eight o'clock round on time, finishing some twenty minutes later, and then went into boiler house. Watchman reported all conditions normal on his round. It would be impossible for watchman to see the fire while in the boiler house, as the shutters were closed and side wall blank towards main building. Upon alarm three volunteer hose companies responded, placing hose streams in service in about ten minutes. In all seven or eight streams were used, mostly from private hydrants in yard or inside the forge shop. The hydrants in forge shop were on the four-inch main supplying the sprinkler equipment and greatly reduced the supply and pressure to system. After steam pump was started, shortly after discovery of fire, the sprinklers aided in checking the fire and pump was kept in operation until it was of little assistance due to water wasting through broken sprinkler piping, fire being under control by this time. Steam pump service was defective, as same could only be used on the hydrants by feeding through the sprinkler system.

It is stated that the hose streams lacked force. This was probably due to the defective arrangement of the private protection, all hydrants and sprinkler system being fed through the four-inch main connected to a ten-inch main about two miles distant, also partly due to the long lines of hose and large number of sprinklers in operation. This must have greatly overtaxed water supply and pressure. The recording gauge on the waterworks system, which normally shows a pressure of 100 pounds, dropped to between 40 and 50 pounds during fire, and even the opening of the valves in supplementary supply mains from the larger and higher reservoir failed to give increased pressure at recording gauge during the fire. The waterworks and steam pump supplies were in service for about four hours.

Fire was confined to the main building, the first floor near the point where fire started and the upper floors being practically destroyed. This building was about forty years old and floors were badly oil soaked. The brick wall acting as a partial cut-off between rear wing of main building and frame forge shop enabled firemen to prevent fire from spreading into forge shop, although, as stated above, the frame addition extending beyond

fire wall seriously detracted from its protection. The two openings through fire wall were closed with poor fire doors, which were of assistance in checking fire. Fire doors in passway between second floor of main mill and office and finished goods storage building greatly assisted firemen in checking the spread of fire in this direction.

The operation of the sprinkler heads was apparently satisfactory, their failure to control the fire being primarily due to the following cause :—

Fire started in unsprinklered section and spread rapidly through the building by way of open stairs and elevator shaft. Sprinkler system was not standard, pipe sizes being too small and arrangement of heads poor. The large number of sprinklers opened practically at once, together with the hose streams draughting from the one four-inch connection, greatly depleted water supply and pressure. Floors were oil soaked. The attic contained a large amount of combustible material, which added greatly to the intensity of the fire.

The results of this fire also show the need of complete and efficient alarm service. Had system been equipped with sprinkler alarm, watchman would have been notified of its progress before it was beyond control. Hydrants should not be installed on sprinkler system connections. Loss large.

Summary: Unsprinklered portions. Deficient equipment.

10395. November 6, 1910. Paper Mill. At 7.30 Sunday morning a repair man, working in the basement of machine room building "B," discovered fire coming from over one of the stuff chests, and described same as emitting green and blue flames with dense smoke.

The cause of the fire was probably due to a short circuit and arcing taking place in an improperly hung and protected electric light circuit which passed along the floor timbers over the stuff chest. The description given by the man who first discovered the fire would seem to bear out this theory. In addition, the electric light wiring in this basement was very old and poorly constructed, the wires having been frequently cut, the insulation was worn off in many places, and the main circuits were in contact with pieces of iron, sprinkler piping, etc. The current could not be shut off from the basement lights except when the generator was stopped, as there was no switch for this purpose. There were no fuses on any part of the line between this basement and the generator. The only safety device consisted of an automatic circuit breaker which is set to open at one thousand amperes. Under these circumstances a short circuit might occur in the small lighting wires in this basement and continue for an indefinite time without any liability of opening the circuit.

The alarm was immediately given and the steam whistle was blown and in a short time a large company of men responded from inside and outside the yard. Hose streams were manned and directed into the basement through the low basement windows. The public fire department also responded, the town chief taking charge of the fire fighting. The streams

being directed in through the low basement windows probably struck the floor and did not reach the seat of fire, which was near the ceiling, with the result that it rapidly spread sideways and also upwards through belt holes and over the dried stock on the wall until it reached the roof of the building, which was constructed of plank on four by eight inch purlins, ceiled for two-thirds of its length on the under side of the purlins to prevent condensation. The fire almost immediately got into the concealed space, with the result that half or two-thirds of the roof was destroyed. The only way in which the fire could be reached was by cutting holes in the roof and attempting to flood the concealed space by the use of hose streams. On account of this ceiling and of the difficulty of handling the fire in the basement, it was not finally extinguished until about 4.30 in the afternoon.

The building was thoroughly equipped with an automatic sprinkler system and there is no doubt but that the water was on same. Hence it was at first difficult to understand why the sprinkler equipment had not held and extinguished the fire. An examination after the fire disclosed the fact that some of the sprinklers were plugged with tubercular scale, probably from the cast-iron mains, together with cinders, small pebbles, pulp and dirt. It is probable that these obstructions clogged the first sprinklers to open, with the result that the fire gained headway and opened such a large number of heads, some two hundred, that the water supply for same was crippled.

During the progress of the fire further delay occurred, due to the blowing out of two leaded joints in the yard main, which necessitated shutting down the hydrants, after which time there was no supply of water for the sprinklers and the fire had to be fought wholly by hose streams taken from the connections on the Underwriter pumps and by streams furnished by the town steam fire engine, which took its supply of water from a filter tank in the basement of the wet machine building. In all, some nine hose streams were used during the progress of the fire. The Underwriter fire pumps did good service during the continuance of the fire and it is probable that if the employees had been well organized to fight fire, it would have been extinguished in its early stages without much loss.

About two-thirds of the roof was badly burned, the floor somewhat damaged, and considerable stock stored in one end of the building damaged by water. Loss approximately $7,000.

Summary: Sprinkler heads clogged with scale and sediment.

10413. November 14, 1910. Photo-Engraving. Fire occurred from unknown cause, about 7.30 p. m., on the fifth floor, occupied by a photo-engraving firm, of a tenant manufacturing building. Building was six stories and basement in height, brick, mill construction without concealed spaces, belt holes being the only floor openings. Employees on the floor below who were working overtime saw smoke coming through belt hole and gave the alarm. The mechanical type of sprinkler alarm on the dry valve is said to have operated. Watchman failed to discover fire. He states that

he had made round, but no record of the round showed on the dial of clock. Fire should have been discovered on this round.

Building was equipped with Grinnell glass disc sprinklers, installed a few years ago. Pipe sizes were old standard installed in 1890. Sprinklers were spaced nine by eleven feet under open beam ceilings not staggered. Dry system was controlled by a four-inch Grinnell differential dry valve which supplied all sprinklers in building, 840 heads in all. Primary water supply was from an automatic steam pump giving a static pressure of from twenty-five to thirty pounds. Secondary supplies were from gravity tank and steamer connections and were of service owing to failure of the pump supply.

The section in which fire started was of plank and timber construction with seven foot bays. Sprinkler lines, instead of being placed in bays parallel to timbers, were transverse, the lines being beneath the timbers of bays, placing the sprinklers about eighteen inches from ceiling, many heads being placed directly under beams. Sprinklers were also somewhat obstructed by the numerous frame partitions.

The fire department responded promptly upon alarm of fire. Engineer of building operated fire pump until water flooded the cellar and extinguished boiler fires. He then notified fire department, who connected with the steamer connection of sprinkler system, giving much assistance. The gravity tank was found empty after the fire.

Practically all the sprinkler heads in the east section of the fifth and sixth floors opened. Chief of fire department states that fire had evidently been burning for sometime before discovery and that sprinklers did not operate until fire had gained considerable headway. Dry valve operated satisfactorily and was found open after fire. If the system was in service it is hard to account for the failure to control fire in its incipiency or for the opening of the large number of sprinklers, as floors were well cut off except for two belt holes eight by eight inches. The ceiling was badly charred even directly above sprinklers, as though no water had been discharged until after fire had gained considerable headway. The large dry system, old standard pipe sizes and defective spacing would have influenced the number of sprinklers opening and the lapse of time before water was discharged from sprinklers, but it is more likely that the sprinkler system was shut off at the time fire was discovered and valve opened after alarm was given.

The ceiling of the fifth floor was burned through in two places and the frame partitions and subdivisions were also badly burned. There was practically no damage west of the division wall which checked fire at this point with the assistance of sprinklers. The greatest damage was from the water, the fire department being in operation for about two hours, which with the sprinklers practically flooded the lower floors. The slow burning construction of the building prevented a much larger loss. Loss approximately $20,000.

Summary: Water shut off.

10442. December 4, 1910. Woodworker (Interior Fixtures). Fire originated from unknown cause at 4.30 p. m., in the one and two story frame lumber shed, 75 by 300 feet in area and twenty feet high, situated from ten to fourteen feet east of the east wall of the mill building and running at a slight angle to the mill building and adjoining cabinet shop. The oil house used for the storage of oils and varnishes, and the smaller storage shed, 22 by 120 feet in area and eighteen feet high, were situated on the west side of lumber shed adjacent to the southeast end of mill building and extending alongside cabinet shop. The lumber piled in the yard to within sixteen feet of the south wall of cabinet shop and the frame storage sheds only a short distance away created a very severe exposure hazard to mill and cabinet shop buildings.

The mill building was 64 by 100 feet in area, three stories and basement in height, brick joist construction with gravel roof. This building communicated with the cabinet shop on the south through openings on each floor protected by standard automatic metal-clad fire doors. The exterior openings in east wall and angle window openings in south wall were protected by standard metal windows glazed with wired glass.

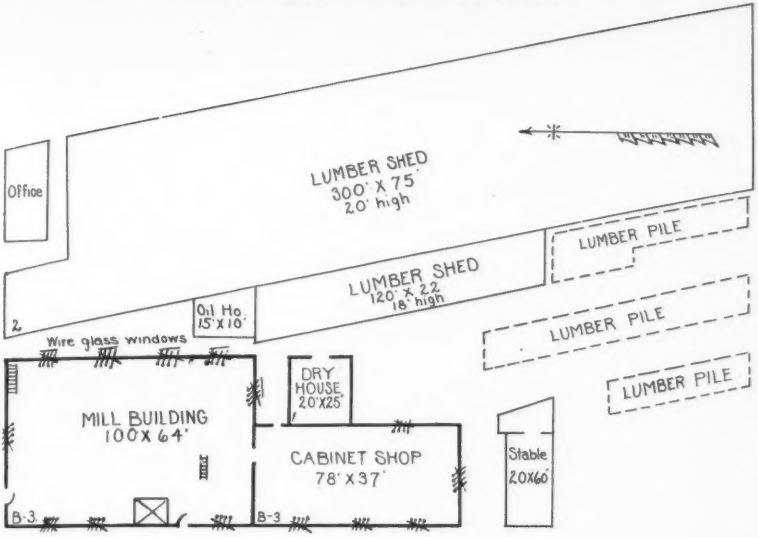
The cabinet shop adjoining mill building on the south was 37 by 78 feet in area, three stories and part basement in height, brick joist construction with gravel roof, exterior openings provided with wooden frames glazed with ordinary window glass.

The dry house which adjoined cabinet shop on the east side about twelve feet from mill building was one story in height, twenty-one by twenty-four feet in area with two brick sides and frame ends. One brick side wall was the party wall between dry house and cabinet shop.

These three buildings were protected with a standard dry-pipe sprinkler equipment controlled by Evans dry-pipe valves and equipped with International sprinkler heads. The mill building was protected with a five-inch system. Total number of sprinklers in building was 424, largest number of sprinklers on any one floor, 107, sprinkler heads covering an area of about 64 square feet. The cabinet shop was protected with one four-inch system supplying 164 sprinklers; largest number of sprinklers on any one floor, 53, sprinklers covering an average area of about 64 square feet. The dry house was protected by nine sprinkler heads.

The sprinkler equipment was supplied by one six-inch connection from a six-inch city main, 70 pounds pressure; a 1,800 gallon gravity tank elevated twenty feet above roof of main mill building and two four-inch steamer connections.

The fire after its discovery spread with great rapidity and the sheds and lumber piles were well afire by the time of arrival of the fire department. An east wind forced the heat and flames against the east and south walls of the mill building and cabinet shop, the exposure being very severe. The metal windows glazed with wired glass protecting the exterior openings, east and south sides in the mill building, stood up well. The glass and frames remained intact; some of the exterior brick work and stone walls



Fire No. S-10442.

were badly checked. Some finished fixtures in the south part of third floor that were within fifteen and three-quarters inches of the wired glass windows were ignited from the radiated heat. There were three sprinklers opened on the third floor and one sprinkler opened on the second floor of the mill building. There was considerable loss to contents in this building from water from the sprinklers. The fire loss, however, was confined to material which was located near wired glass windows which was charred.

All the wood window frames in the east and south walls of the cabinet shop were burned out and the east wall of this building was so badly buckled that it will probably be necessary to replace it and the exterior bricks of this wall were badly checked. There were 117 sprinkler heads opened in this building supplied, in addition to the connections from the city mains and gravity tank, by the fire departments pumping through the steamer connections. Although the flames from the other buildings must have been blown directly into this building when fire was at its height, the sprinkler equipment prevented the fire from getting any hold upon the interior of the building except in a small space in ceiling of third floor which was sheathed with metal, the metal becoming sufficiently heated to ignite the joist above. The dry house was practically destroyed. The sprinklers protecting this building were not effective, as the fire apparently burned from the roof down and the dry house being provided with wood ceiling prevented distribution of the water from the sprinklers into the joists. Loss approximately $24,000.

Summary: Exposure fire.

10443. December 9, 1910. Patent Leather Tannery. Fire occurred from unknown cause in the concealed space between the tin top of a patent leather dry room and the roof joists. Alarm was given by employee about 8.15 a. m , upon discovery of fire, the sprinkler alarm failing to operate. Sprinkler alarm was of old type and out of order at time of fire.

The third floor of the three-story brick joist constructed building was occupied for the japanning and drying rooms. Floor was double board, roof constructed of seven-eighths pine boards on three by ten inch pine rafters, eighteen inch on centers, supported on eight by ten inch girders and columns. Ceiling of roof was sheathed with tin over the patent leather dryers.

The third floor was protected with Grinnell 1888 pendant sprinklers installed with pipes in 1889. Sprinklers were on the wet system, spaced ten by ten feet on old pipe sizes. Primary water supply to system was from waterworks giving 60 pounds pressure. Secondary supply was from a 5,000 gallon gravity tank elevated ten feet above roof. There was also a steamer connection which was used by fire department, supplementing the waterworks and gravity tank supply.

Upon receipt of fire alarm the public fire department responded promptly with six engines, using eight to ten hose streams on the fire. Water supply was reported ample.

The dry wood of the dry kiln, roof joists and surrounding woodwork spread fire rapidly, the excessive heat opening a large number of sprinklers. Sixty-four of the 77 sprinklers on this floor were opened, but these were of limited value as they were beneath the tin top of dry room, leaving the concealed space unsprinklered, where fire could spread unmolested.

Through the efforts of the fire department, with the slight assistance from sprinklers, fire was confined to the top floor of the building. When fire was nearly under control, part of the roof collapsed, breaking down about a third of the sprinkler equipment and putting the system entirely out of commission. By this time the fire department had the fire well in hand. Loss was mainly on roof and water damage to stock on lower floors. Over half of the roof, japan and drying room, and some leather were burned. Loss approximately $50,000.

Summary: Concealed space.

Fire-Resistive Buildings---Fire Record.

These fires are selected to illustrate the behavior of various forms of fire-resistive construction under exposure to fire from within or without.

H-5934. October 3, 1910. Tenant Manufacturing Building. This building of fire-resistive construction successfully prevented the spread of a severe exposure fire in its direction or the entrance of fire into the building. Building was about fifteen years old, 105 feet in height, about 9,000 square feet in area; outside walls were of brick with stone trim, with brick roof. Window frames and sash were of wooden construction glazed with ordinary plain glass and were protected by flat frame crimped iron shutters. The interior construction was concrete on segmental brick arches, on steel beams and girders supported by cast-iron columns. Floors were covered by double wood flooring nailed to wooden sleepers set in the concrete. There was one fireproof tile partition on the second floor.

The cast-iron supporting columns were unprotected; the girders and lower flanges of beams on the seventh floor and in stair shafts were also without protection, otherwise the lower flanges of beams and girders were protected by one inch of concrete. Interior walls were open finish.

Stairs were of iron construction with slate treads. The three elevators were enclosed in terra cotta tile shafts, openings protected by steel rolling doors except one passenger elevator which was equipped with sliding doors. Stair openings into rooms were closed by sash doors and windows.

The fire totally destroyed the two buildings in the northeast corner of the block, but the damage to the fire-resistive building was slight, consisting mostly of water and smoke damage. The shutters were in fair condition and mostly closed, undoubtedly saving the building from severe exposure. There was no structural damage, with the exception of windows exposed by the burning buildings. In some instances the glass in windows was broken and in several cases the frames and sash were badly charred from the heat, the shutters at these points being slightly open. Loss small.

H-6203. October 16, 1910. Sugar Refinery. Fire occurred from unknown cause at 1 a. m., on the tenth floor of the filter house. Filter house was of the following construction: brick walls, concrete and steel floors, steel being poorly protected by wire lath and plaster; and cast-iron supporting columns which were also without protection.

This building was protected with a modern system of automatic sprinklers installed in 1910. Sprinklers were of the Neracher No. 6 Upright type, on wet system, supplied by a 50,000 gallon gravity tank giving a static pressure of twenty-three pounds on sprinklers first opened. The sprinklers were staggered spaced, eight and a half feet across by nine feet with ceiling pockets. There was no obstruction to distribution. Five sprinklers opened and practically extinguished the fire, the fire department responding but not using apparatus.

Sprinkler system was equipped with a Grinnell variable pressure alarm valve connected with electric and hydraulic outside gongs and to annunciator in timekeeper's office where the watchmen make their headquarters. This alarm operated properly and notified the watchmen, who discovered the fire in progress.

The fire apparently started from unknown cause in a pile of dry canvas filter bags piled in the bag repair room. It is probable that had building not been equipped with sprinklers fire would have burned itself out before endangering the poorly protected steel beams and cast-iron columns, on account of the small amount of inflammable material present.

There was practically no loss to building and but slight damage to the filter bags charred and burned.

S-10417. November 3, 1910. Chair Factory. Fire occurring between 7 and 8 p. m., in the plant of the adjoining bottling works, severely exposed the furniture finishing and warehouse building which was of fire-resistive construction. The buildings of the bottling works were from one to three stories in height, of ordinary brick and frame construction and adjoined the furniture warehouse for a distance of 55 feet on the rear. The wall of warehouse at this point was blank to a height above exposure, but there were unprotected window openings on both sides of the blank section of wall and it was through these openings on the second floor that fire entered and slightly damaged the warehouse. The furniture warehouse was of excellent reinforced concrete construction. The floor construction was as follows: A four-inch slab of concrete, stone aggregate, with three inches of weak ash concrete fill and a one-inch board top, floors not being pitched to drain.

Warehouse was protected by Grinnell glass disc sprinklers installed in 1908; modern spacing and arrangement, on wet system, supplied by a 37,000 gallon gravity tank, the only supply. This gave a pressure of 32 pounds on sprinklers first opened. Two sprinklers were opened during the fire.

The fire occurring at a time when the entire fire department was fighting a large fire some distance from warehouse, delayed the fire department from responding to the second alarm, and public protection did not arrive until the buildings of the bottling works were wrecked, and all that could be done was to protect adjacent property. The fire attacked the warehouse building at the unprotected angle windows, burning window frames and sash

and breaking glass. Two sprinklers, however, immediately opened and checked the fire from entering, the sprinkler equipment proving of great value, as this floor was packed with highly inflammable furniture, and fire once started would probably have destroyed the contents of the entire floor before control.

The loss was largely water damage to the unfinished stock of chairs and to some upholstery stock stored in the basement. This stock was said to have been skidded four inches, but there was nearly a foot of water in the basement, the water from hose streams entering the basement through windows which opened onto a depressed concrete area way.

As stated above, the floors were not pitched to drain and the water slowly seeped through second and first floors. This seepage was most pronounced around the steam and water pipe hangers that were anchored through the concrete floor slab.

This method of hanging the steam and water pipes consists of drilling through the concrete slab, inserting the hanger and securing it in place with washer and nut on the upper side of the slab.

The above method of securing pipe hangers in fire-resistive buildings is not to be recommended. Construction which impairs the waterproof ability of floors is of great disadvantage.

Where feasible, floors should be built with a slight pitch so as to drain all water into an elevator shaft or properly designed scuppers connected with drain pipes.

The exposing building was of old type and burned with great rapidity, the fire-resistive building undoubtedly stopping its spread in its direction. This was of great value, as fire department was heavily handicapped in coping with the other large fire in progress at the time.

H-5935. December 3, 1910. Mercantile. Fire occurred from unknown cause about 2.03 a. m., in a sample room partitioned off from the fifth floor of the eight-story fire-resistive building occupied for the wholesale of men's furnishings. Fire was first discovered by a policeman, who smelled smoke and searched for fire for a long time before sending in a still alarm at 2.03, the bell alarm being given by firemen at 2.20 a. m. When the firemen entered the fifth floor, the smoke was very heavy and dense but there was very little blaze. The inrush of fresh air caused the fire to blaze up with the force of an explosion. This was soon controlled by the fire department, fire being confined to the fifth floor.

Building is eight stories and basement in height, built in 1908, exterior walls of brick and stone. Columns are steel, built up of plate and angle sections; exterior columns are protected by brick and wire lath and plaster, those near point where fire occurred being protected by brick; interior columns are protected by concrete applied by monolithic moulding in forms, there being at least three inches of concrete outside of the fabricated steel columns. Girders and beams are of reinforced concrete. Girders are twelve by twenty-one and a half inches below floor slab, beams measuring

eight by eighteen and a half below floor slabs. Beams are spaced seven feet apart. Girders and beams are reinforced by round rods about one inch above lower surface of concrete. Floor slabs are five and a half inches thick, reinforced by round rods three-eighths of an inch in diameter, spaced eight to nine inches apart. Floors are covered with two-inch spruce planking with a one-inch maple wearing surface. The mixture of concrete used was one part cement, two parts sand, and five parts stone aggregate. Roof is covered with gravel. Finish of outside walls is brick and stone. There are wired glass windows on exposed area way at back of building.

The interior finish of the building is part plaster on the brick walls and part open. Stairway and elevator are cut off by a terra cotta block partition with paneled metal and wired glass doors in opening into stairway enclosure and two-inch metal-clad fire doors at elevator openings from main floors. Elevator openings into stairway enclosure are unprotected. Dumb waiter is protected in an approved manner.

The fifth floor was filled with wooden shelving and racks containing a stock of hosiery and sweaters. The corner of the fifth floor where the fire started was used as a sample room and was practically a part of the main room, as the partition did not extend to the ceiling. Here the man who has charge of the room and a young lady worked all day up to 5.30 p. m., filling fancy Christmas boxes with hosiery. Just outside the partition were four or five iron coat closets with wire fronts. On the party wall at the other side of the sample room was the box for the electric switches, etc., for this floor. The wires were in conduit and passed up through the concrete slab through a hole that had been cut for that purpose. This hole had been left rough and was slightly larger than the area of the pipes, but was not excessive. It proved large enough, however, to allow the fire to extend to the floor above. Fire was confined to the sample room of the fifth floor, with the exception of the small damage on the sixth, due to fire spreading through the hole in the concrete slab made for the passage of pipes. This was confined to a small area.

Two of the wired glass angle windows were cracked by the heat, but the glass held in place. One upper sash opened a little and settled out of place, probably due to the pivots springing out of their sockets, caused by the warping of the sash. These windows were of much value, as they were located in the corner of an area, the angle being very acute, and the windows of the adjoining building being only a few feet distant.

There were several places on the bottom of one concrete girder where the surface of the concrete scaled off and was softened to a depth of three-eighths of an inch to one-half inch. These places can be easily repaired by a little cement. Fire burned through the three inches of wood flooring to the concrete in two places about five or six feet apart. One of these places was inside of the sample room partition and one outside in a passageway. Neither of these places was under the spot in the concrete girder where the concrete was injured. The remainder of the room, outside this corner was filled with wooden racks holding hosiery and sweaters in paste-

board boxes. Many of these boxes were badly discolored by the smoke and a few of the racks were charred. The contents of the boxes were apparently uninjured but damaged for sale purposes by the damage to the boxes. The stock inside the sample room consisting of hosiery and fancy Christmas boxes was destroyed. The damage to the sixth floor was very small. There was no damage by water to the floor below excepting a slight amount of water which seeped through a crack in the concrete. This building shows several large cracks in the centre of the slab running across the building, one marking the joint in the laying of the concrete between one day's work and the next. Outside the crack, the concrete held the water without leakage. There was a water damage on the first floor due to the bursting of a hose in the vicinity of a stock of silk handkerchiefs and expensive gloves.

The cause of the fire is unknown. The coat locker and the electric wires were the only things near where the fire started, as far as is known, that could have caused it. No smoking is allowed in the building by the employees.

Loss on building $1,504, on contents $61,074.06.

Miscellaneous Fires.

Interesting fires are given under this heading without regard to their classification.

H-5442. Mercantile. Fire occurring from unknown cause at 2 a. m., completely destroyed the building and contents. Building was one story high, seventy-five by ninety feet in area, side walls of concrete blocks with wooden joists and wooden interior construction, with the exception of a concrete block division wall. Roofing was composition on wooden construction. Interior walls were finished with plaster. Concrete blocks were a mixture of about one part cement to five or six of sand.

The contents and wooden construction of the building were totally destroyed, fire also spreading and destroying a frame building adjacent. The two side walls, the division wall and a part of the rear wall were standing after the fire. These walls, however, were practically worthless and were condemned. The side walls were considerably warped from the unequal expansion due to the intense heat applied to one side only. The partition wall, where heat was practically equal on both sides, was nearly plumb. Walls appeared considerably softened and crumbly after fire, but were much harder where finished with plaster and where the plaster did not scale from wall during fire.

H-5641. Laundry. Fire which endangered the lives of the large number of employees, mostly women, and caused a loss of approximately $41,000, started in the dry room of steam laundry from unknown cause at 7.43 a. m. The cause has not been positively ascertained, but from the statement of the employee who first saw fire, it seems probable that it was caused by the ignition of a celluloid collar stay which had been left in the collar of a woman's shirt waist. This waist, with others, was hanging in the dry room, the temperature of which was about 140°. The collar stay was a strip of celluloid about two inches long and a quarter of an inch wide, and must have been hung sufficiently close to the steam pipes to become overheated and ignite. In an instant the inflammable contents of the dryer were ablaze. Laundry building was of modern brick and joist construction, three stories and basement in height, and equipped with standpipes and manually operated trap doors to elevator shaft and stairway. There were large area windows on all sides, in fact the exterior walls were mainly composed of glass. The openings in the east and south

sides were protected with wired glass in metal frames, window openings on the front sides being glazed with ordinary glass. Building was situated on the corner of block. The wired glass windows on the east side, although held partly open, gave good protection to adjoining property, but the heat was so intense on the south side of the building that the glass was melted out of the frames and adjoining buildings were damaged.

The dry room in which fire started was located in the basement near the elevator shaft and was constructed of tongued and grooved boards lined inside with asbestos and galvanized iron. The floor of dry room was cement. Dry room was heated by steam pipes on a rack in the center of the room.

By the time the fire department reached the fire it had spread and gained too great headway to make it possible for them to do more than rescue the employees and protect adjacent property. The rapid spread of fire was due to a large fan used in the dry room to keep the air in circulation which when the door was opened created a strong draught, spreading fire up the open elevator shaft near by. The employee discovering fire ran to the standpipe but found that hose had not been provided and was forced to leave. The employees having barely time to escape could not close the trap doors on elevator shaft or stairways and fire soon enveloped the building and its inflammable contents.

Fire department used thirteen hose streams on fire finally checking and extinguishing same, but not until the building and contents were practically destroyed.

The culpable negligence on the part of the owner in not supplying proper private protection and efficiently safeguarding the floor openings through which fire spread with such rapdity, endangering the lives of the employees, should be emphatically condemned.

5646. Metal Worker (Harness Hardware). Building was 14,000 square feet in area, one story high and constructed with reinforced concrete walls and concrete floor with a wooden roof covered with composition roofing. Roof was supported with wooden posts and there were also numerous wooden partitions in building. These were of such an inflammable nature that building was actually one fire area. The building contained the complete processes of the manufactory, these exposing each other through the frame partitions. The contents of the building and the stock in process was largely of a non-combustible nature; *i. e.*, wire, sheet metal, iron rods, etc., and the processes were mainly heavy stamping, wire bending machines, lacquering, etc.

The cause of the fire is unknown. Fire was first discovered at 4 a. m. by the watchman of an adjacent plant, who gave alarm through the public fire alarm box. Fire was bursting through the roof at this time and spread with such intensity over the combustible roof and partitions that contents were a total loss before fire could be extinguished.

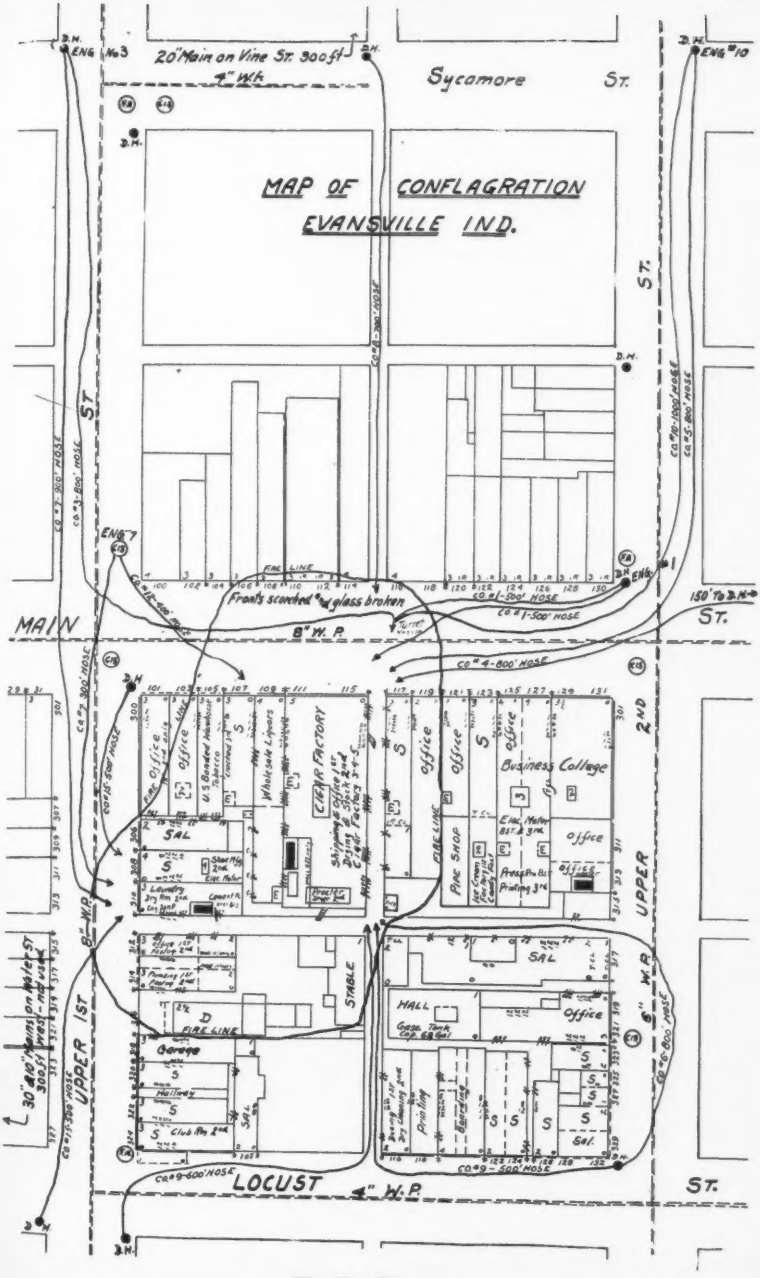
The proportions of the concrete mixture, cement, sand and gravel could not be obtained. The walls were not first class, in that small cracks had appeared in some sometime previous to the fire. The floor was in good condition after the fire and the walls did not disintegrate or weaken to any extent, the only damage being from pitting. Loss $20,000.

H-5970. Tobacco Factory. The conflagration started from unknown cause about 2.30 a. m. in the Fendrich tobacco factory. Fire was discovered at approximately the same time by several persons. Those first noticing the fire state that the flames were issuing from the third, fourth and fifth floor windows, their attention having been drawn to it by the breaking and falling of the window glass. Fire department received a still alarm at 2.43 a. m., and upon arrival of the department at the fire the chief pulled the alarm box at 2.45, following with second alarm at 2.48 and third alarm at 2.50 a. m.

Construction and Occupancy. The buildings in the burned section ranged in age from twenty-four years to between forty and fifty years. Heights varied from two to five stories. Walls were of brick, mainly thin party walls generally deteriorated, and bricks were laid with lime mortar. Parapets were generally deficient in thickness and height, uncoped in several instances, and deteriorated. Several frame, iron-clad rear walls existed. Numerous rear and side wall openings and the entire absence of protected openings were noted. Roofs were of metal. Floors, single and double thickness, ordinary joist construction; joists were generally footed in the light party walls. Numerous elevator, stairway and light well openings unprotected. Interior protection in but one instance. Heating, private plants and stoves. Lighting, principally gas with a few electrical equipments, non-standard installations.

The Fendrich building, in which fire originated, was located at 111-115 Main Street. (See plan.) Details of age and construction are as follows: Age, twenty-four years; height, five stories with basement; floors, double thickness laid on joists supported by a center row of unprotected, cast-iron columns and side walls; ceilings, wood sheathed and coated with shellac. Heavy outer bearing walls with a sort of pressed brick facing not well anchored, and laid with lime mortar; front wall largely glass and iron, backed with concrete. Side and rear walls contained numerous unprotected window openings. Roof, metal; ten non-standard skylights. Open light shaft from first floor to roof; one double elevator shaft and one stairway from basement to fifth floor; numerous belt openings; no floor traps.

Heating, steam. Lighting, gas arc lights with electricity in office. Interior protection, one hundred feet of one-inch hose on each floor, eighteen three-gallon chemical extinguishers distributed; no watchman. Occupancy, 700 to 800 hands employed, mostly girls. Basement, engine and boiler room, box nailing and crating, storage of knock-down



Fire No. H-5970.

boxes and ammonia drums. First floor, offices, shipping and storage. Second floor, storage of raw stock and drying; copper-lined steam-heated Procter dryer and scenting oven set on concrete laid over wood floor. Third, fourth and fifth floors, cigar making; nine barrels of essential oils, blending extracts and alcohol in frame enclosure on fifth floor near elevator. The air was generally permeated with a very fine tobacco dust on these floors.

The occupancies of buildings in the fire area were as follows: 101-103 Main Street, railway ticket office and express office, first floor, offices second floor; 105 Main Street, tobacco storage, bonded warehouse; 107 Main Street, postal telegraph office first and second floors, vacant third floor; 109 Main Street, wholesale liquors basement, first and second floors, vacant third and fourth floors, pigeon roost part of fourth floor; 111-115 Main Street, Fendrich cigar factory; 117 Main Street, tailor shop first floor, vacant second and third floors; 119 Main Street, express office first floor, vacant second floor; 306 Upper First Street, saloon first floor, dwelling second floor; 308 Upper First Street, small shoe factory first floor; storage second; 310 Upper First Street, vacant; 312-314 Upper First Street, offices and plumber first and second floors, photo gallery second floor; 316 Upper First Street, dwelling. Rear 312-314 Upper First Street, livery barn and small amount of paint mixing.

Probable Cause and Extent. The exact origin of the fire has not been definitely determined. From the statements of those who first saw flames it was likely of an explosive nature, as flames were seen issuing from all sides at about the same time, the glass in the windows of the three upper floors being shattered as by a heavy pressure from the inside.

In the rear of the fifth floor, contained in a frame enclosure, were stored nine barrels of essential oils, blending compounds and alcohol. The barrel of alcohol had a wooden spigot for drawing off the liquid. The upper floors were illuminated by gas arc lights, equipped with pilot burners, and the cause might be assumed to have been from the ignition of alcohol vapors from the open gas flames.

The fire communicated back to the oil room, the heat bursting the barrels. The volatile liquid at once ignited and ran down the open stairway and elevator shaft to the floor below. The ceilings were wood sheathed and heavily coated with shellac, and this condition, together with the collection of tobacco dust, would facilitate the rapid spread of fire. While this theory is not substantiated, it appears to be the most probable.

Four men who were working in the engine room in the basement of the Fendrich building at the time of discovery of fire heard several dull shocks and ran outside to find the building enveloped in flames. Some of them returned to get their clothing, but were driven out by the intense heat.

Upon the arrival of the first fire companies the flames were bursting from the openings on the second to fifth floors. Three alarms were

immediately sounded, calling out all fire companies. The first company had barely gotten into action before the upper floors began to fall. The intense heat upon the unprotected cast-iron columns caused them to buckle and collapse under their load. Some of the columns were found badly bent and twisted but not cracked, indicating that the temperature of the metal had very nearly reached the melting point of cast iron (2,280 degrees Fahrenheit).

In less than twenty-five minutes after the arrival of the first fire companies the walls began to sway and fall. These walls were of heavy construction with bricks laid with lime mortar, which deteriorates rapidly under heat. The outer facing of walls was not securely anchored to the backing bricks. The east walls, from the floor line of the third floor, fell out, crushing the adjoining buildings, 117-119 Main Street. The west wall apparently fell out on the fourth and fifth floors and inward on the first, second and third floors, carrying with it building No. 109 Main Street and wrecking building No. 107 Main Street. A fire occurred in the same location as the Fendrich building some twenty-five years ago, badly damaging No. 109 Main Street, which was patched up, leaving building in a weakened condition. When building No. 107 Main Street fell it tore out a part of the upper walls of No. 105 Main Street.

During the progress of the fire the wind was from the north and northwest quarter, the changes of direction which occurred being due to the air currents caused by the intense heat. Through the medium of extremely light party walls, frame rear walls and the entire absence of protected horizontal openings, the flames readily communicated to the rear of the Upper First Street buildings. With the slight moderation of heat on the Main Street side of the fire and the increased intensity of heat on the First Street side, the air currents were shifted to a direction from the south, driving the fire back over the burned district. The intense heat broke all of the windows on the north side of Main Street exposed by the fire, and blistered the paint on the fronts of buildings. Some small blazes ensued but were extinguished The spread of fire was materially retarded by the heavy fall of snow which remained on the roofs of buildings; and had it not been for this condition, unquestionably, the fire would have extended over a much larger area.

How Extinguished. Upon the arrival of the first fire company all the apparatus in the city was called. The departments generally were rather slow in arriving at the scene of the fire on account of the heavy snow, the slippery streets and the horses being smooth shod. An approximate layout of the hose lines is shown on the accompanying plan. A two-inch turret nozzle was set in front of the Fendrich building, playing upon the fronts of buildings on the north side of Main Street and upon the fire; nozzle served by three engine streams. Some little time was lost in getting engines into service, as the water in the boilers was

not kept hot, heaters not being in service. Engine No. 7 was first set at the hydrant on the corner of Vine and First Streets, with 1,000 foot layout of hose, but was moved later to the cistern near Main and First Streets and the line shortened to two 400 foot leads. Engine No. 3 was located at hydrant on the corner of Sycamore and First Streets, with one 800 foot and one 900 foot line. Engine No. 10 was located at hydrant on the corner of Sycamore and Second Streets, with one 1,000 foot and one 800 foot lead. Engine No. 2 was located at hydrant on the corner of Main and Second Streets, with two 500 foot leads. Fire cisterns are located nearer to the scene of the fire, but were not used. A 700 foot line was run from the dead end hydrant on four-inch main on Sycamore Street and alley between First and Second Streets. An 800 foot line was run from the hydrant on Main Street and alley north of Second Street. Two lines were run from the hydrant corner Locust and Second Streets, and two from Locust and First Streets. Three lines played from the northeast corner of fire, four on the First Street side, and eight lines, three of which were connected with the turret nozzle, from the Main Street side. Eight of the fifteen lines were served by engines. Only two lines were carried to the roofs of buildings; one on 121 Main Street (aerial truck set here), and one on 105 Main Street. This last line was removed when buildings fell. The congestion of overhead wires in the alley seriously hampered the work of the firemen and entirely prevented the use of any apparatus in the alleys. The lives of some of the firemen were in serious danger several times during the fire.

It is apparent that had they used the cisterns instead of the hydrants, the deficient hydrant streams would have been much stronger. All of the engine and hydrant lines were connected with hydrants fed by eight, six and four-inch pipe, the engines being so located that they tended to take the water away from the hydrant lines. On Water Street, one block west of the fire, were a thirty and ten-inch feeder main supplied by two thirty-inch lines from pumping station. The hydrants on these lines were not used; instead, the ones lying north and east of the fire were selected. This necessitated the water taking a circuitous route through smaller sizes of pipe in order to reach the point of consumption. All of the hose (approximately 12,000 feet), with the exception of a few sections left in the wagons, was laid out by the various companies. The nozzles used were of the shut-off type, having tips with one and one-eighth and one and one-quarter inch openings.

During the fifteen hours' endurance of the fire the remainder of the city was entirely without protection, the only piece of apparatus that could have been called upon being the chemical engine. It was used at the fire as a patrol, following and extinguishing the flying fire brands, some of which fell twelve blocks distant. The work of the chemical engine was excellent, as numerous small fires were extinguished by it. The first companies were sent back some time between 8 and 8.30 p. m.

Fire No. H-5970.
111-115, 117 and 119 Main Street. Right center shows buildings crushed by falling wall. Left shows ruins of Fendrich Building. Note congestion of wiring in alleys.

Fire No. H-5970.
Ruins of Fendrich Building and buildings west and south. Note congestion of wires in alley.

Fire No. H-5970.
General view of 101-109 Main Street. Note unprotected openings. Building 105 Main Street damaged by falling walls, light party walls completely crushed.

Fire No. H-5970.
Ruins of Fendrich Building, 111-115 Main Street, shows cast-iron columns, some being badly bent. Total destruction of building.

Water Supplies. The general distributing system may be considered as good, but the mains in the mercantile district are entirely inadequate to cope with a fire of this magnitude. Both pumps were kept in operation up to the time the fire was under control. The pressure at the pumping station was maintained at 100 pounds until daylight, when it was allowed to drop to 75 pounds. At the time the engines were first set, the hydrant pressure was indicated at 70 pounds. This pressure with a 700 foot layout of hose from hydrant would give a pressure of twenty pounds at the nozzle with one and one-eighth inch tip. The engine pressures were said to range between 150 and 210 pounds at engine. The hydrant streams were weak and of little value.

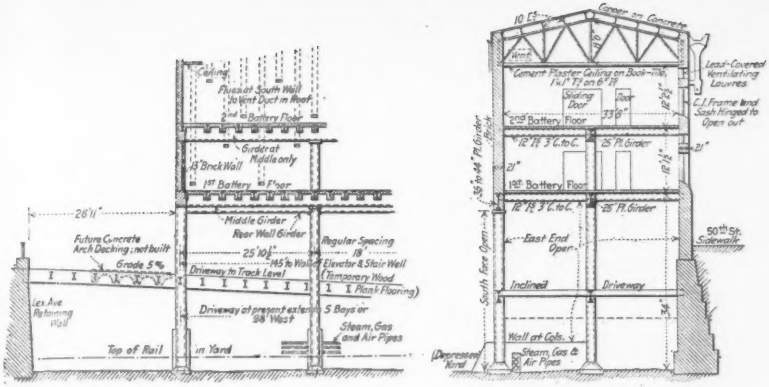
Conclusions. It would seem that the fire could have been fought to better advantage. Had the engines used the cisterns instead of the hydrants a greater efficiency would have been attained in the hydrant streams. Furthermore, long layouts of hose could have been avoided had the hydrants nearer to the fire been used, and greater pressure secured through the large supply mains on Water Street. It would also appear that good results could have been reached by the use of lines on the roofs of nearby buildings, the stands generally taken by the companies being from long range. The operations of the department were hampered by reason of inadequate ladder apparatus and by the congestion of electric wires in the alleys. Deficiency in the manning of apparatus was shown, the remainder of the city being without protection during the fire. Proper assistance was not rendered by the police in keeping back the crowds of spectators.

The fire serves to call attention to the following:—

1. The desirability of good watch service.
2. The weakness and poor resistive qualities of light party walls and parapets and the results of footing floor supports in party walls.
3. The rapid deterioration under heat of brick walls laid with lime mortar.
4. The action of extreme heat upon unprotected metal supports.
5. The importance of protecting vertical and horizontal openings.
6. The danger from oils stored in buildings.
7. The necessity of ample fire apparatus adequately manned.
8. The importance of efficient fire departments.

Insurance and Loss. (Figures approximated.) Property loss, $375,000; amount of insurance, $300,000; insurance loss, $200,000.

H-5988. Storage Battery House. (New York City.) A disastrous explosion in which ten persons were killed and over one hundred and twenty-five injured, wrecked the storage battery house in the Grand Central Terminal yard of the New York Central and Hudson River Railroad and caused considerable damage to adjacent buildings. The easterly part of the storage house was destroyed, a street car passing on Lexington Avenue was wrecked and overturned on a passing automobile



Courtesy of *Engineering News*.

Fire No. H-5988.

Sections of battery house sub-station. Part longitudinal section on the left. Cross section on the right.

truck; houses on Lexington Avenue and Fiftieth Street were partly shattered and minor damage was done over an area within a quarter mile radius of the battery house.

The storage battery house was two stories high, located on the southwest corner of Fiftieth Street and Lexington Avenue, extending along Fiftieth Street west from Lexington Avenue about one hundred and seventy-five feet, and was from thirty-five to forty feet deep to the south on Lexington Avenue. The ground floor was occupied as a carpenter shop; the upper floors as a storage battery room. The depressed yards of the New York Central extended to this building on the south and the area below the building, this area being entirely open on the south facing the yard. The construction of the battery house is shown on the plan which was sketched from the architect's plan. As will be noted from the plan, the lowest floor of the house was some ten to twelve feet above the street evel, while the yard track level was about twenty-two feet below the street. There was thus an open space some thirty feet high under the building, closed on the front by the Fiftieth Street wall of the house and the street retaining wall, but entirely open to the south and east. At half the height of this space there was an inclined driveway built of twelve-inch I-beams carried by deep plate-girders, but lacking its concrete floor arches, and floored instead with temporary wooden planking. This driveway divided the space under the house into two stories, each fifteen to twenty feet high, but both completely open to the south, and the upper story open also at the east end.

The storage tracks in the depressed yard ran north and south to house and ended at ordinary timber bumper posts about at the south line

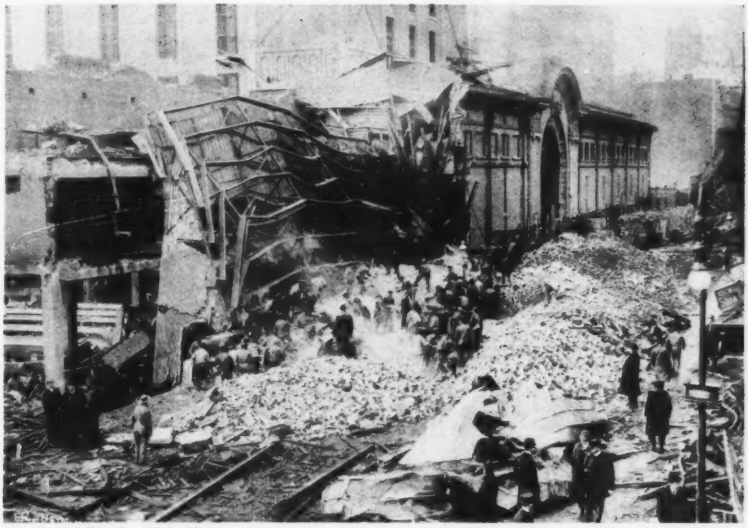
of the house. While standing on these tracks cars were charged with Pintsch gas. A gas storage and distributing system was located about five hundred feet to the south of building where the gas was received by tank cars from the Mott Haven yard and transferred to the storage tanks, service pipes leading from tanks over yard to charging connections. One of these pipes together with compressed air and steam pipes, ran parallel with the length of building in the open space under the battery house. As shown on the plan these pipes were entirely unprotected except where they passed through the low concrete wall between the columns.

At about 8 a. m. a train of multiple unit electric cars in the terminal were being run down against bumper on a track about in line with the second row of columns from the east end of the battery house. The motorman failed to stop the train in time and it collided with and broke through the bumping post. Just back of the front columns in the rear of the bumping post ran the set of three or four pipes carrying the steam, compressed air and Pintsch gas. Debris or stored material struck by the train broke the near-by pipe carrying the Pintsch gas and during the next half hour a large column of gas escaped through the break.

The theory at present most generally accepted as the cause of the explosion is that Pintsch gas escaping from a broken pipe filled the open spaces under the building with a mixture of the gas and air; that this gas and air mixture was ignited in some manner. What the exact cause of the ignition of this gas was no one seems able to say. J. C. Rennard, electrical engineer, filed a report in which he said: "At about ten minutes before eight the operator of the compressor station noticed that the gauge on his Pintsch gas piping system was rapidly lowering, indicating an unusual escape of gas. He immediately left the building and started on an inspection of the yard to locate, if possible, the point at which the gas was escaping. He visited a considerable portion of the yard without discovering the leak, according to his statement, and was returning to his station when the explosion occurred. From the time the pressure gauge indicated the escape of gas until the explosion occurred there would probably escape from the opening at least 20,000 cubic feet of gas, which in combination with the air would furnish an enormous volume of explosive gas. Just what ignited the explosive mixture it is impossible to determine. Several possible causes are evident in the electric light circuits carried in this part of the yard and building, any one of which may have broken so as to form an arc when the foundation was struck by the car. Any open flame, however, would be sufficient to cause the explosion."

Apparently the gas was not cut off from the yard pipes until just before the explosion, about half an hour after the bumping post collision.

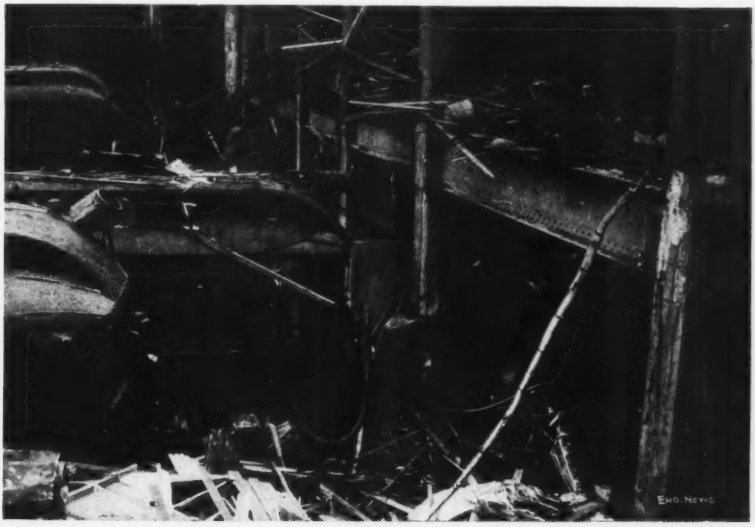
It was stated that the original pressure put on gas storage tanks was about twelve atmospheres. It was further reported that the gauge read about one hundred and fifty pounds before the accident, and when the supply of gas to the broken pipe was turned off, the pressure in the tank



Courtesy of *Engineering News.*

Fire No. H-5988.

Looking into 50th Street west from Lexington Avenue. Wrecked battery house in the foreground. Tops of cars in depressed yard visible at left.



Courtesy of *Engineering News.*

Fire No. H-5988.

View at rear of battery house. The second car in foreground broke through bumping post, wrecking gas pipes.

Fire No. H-5988.

View of building across street adjacent to battery house. Lower windows glazed with wired glass in metal frames which held intact although one light in door was severely shattered. Windows in upper floor were glazed with plain glass in wooden sash. Every light was broken and two sashes blown out.

had fallen to about fifty pounds. It is understood that there were four storage tanks of about seventeen hundred cubic feet capacity each.

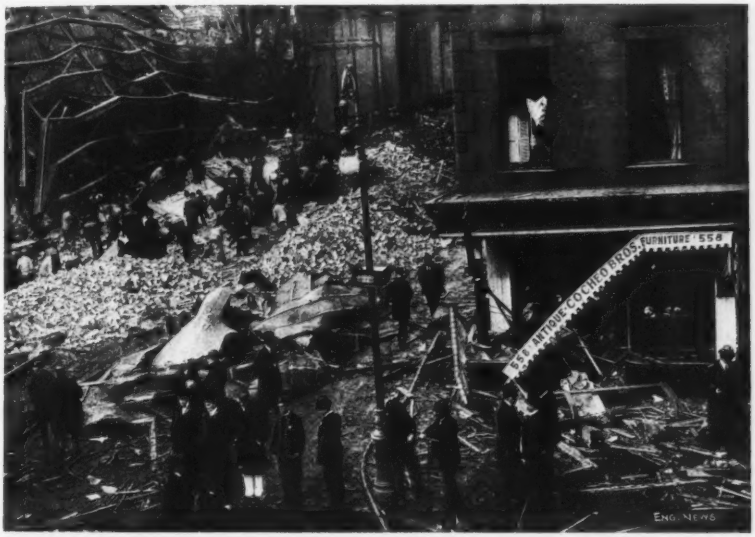
The explosion occurred in or about the battery house. The north wall of the house was thrown down into Fiftieth Street, the upper half of the east wall was blown down, and the floors and roof and roof-trusses fell, the latter hanging from the south wall, which remained largely intact.

The theory held by the authorities is that the gas accumulated in the space under the battery house and exploded there, although this space was open on its southerly long side and the gas was free to escape at this side. This theory does not clearly account for the violence of the explosion or the distribution of damage. Little damage was done immediately in front of the open basement space and practically no flame effects are reported from here. The gas storage station and a dynamite magazine south of it were not injured. Early rumors were to the effect that some dynamite was stored in the battery house but this has been denied by one of the executive officers of the railway.

Courtesy of *Engineering News.*

Fire No. H-5988.

View at east end of battery house.



Courtesy of *Engineering News.*

Fire No. H-5988.

View west into 50th Street.

The damage done outside the wrecked building does not appear to be significant except in a few points. A two-story brick fire house, directly across Lexington Avenue from the wrecked battery house, had the parapet of its west wall, three or four feet high, broken and overthrown on a good part of the length of the building. Lower down, this wall had marks of being struck by several wooden beams, one of which in fact remained sticking in the brickwork. A street car passing between the battery house and the fire house was blown over and badly smashed. North of the east end of the battery house, a tenement on the northwest corner had marks of damage on the cornice of the south wall, and one of the top story windows lacked a triangle of brickwork over the opening. The store front on the ground floor of this house was wrecked. Practically all the damage beyond this consisted in breaking windows, shaking down plaster ceilings, and in a few cases forcing in window and door frames by pressure or shaking down arches of door openings. One building several blocks away from the battery house was found cracked. The area within which windows were broken extends much farther south than north, which may be significant in view of the fact that the space under the building in which the gas is supposed to have collected and exploded is open toward the south. The cars in the railway yard just south of the battery house were not damaged extensively, but their ends and not their sides were toward the explosive wave.

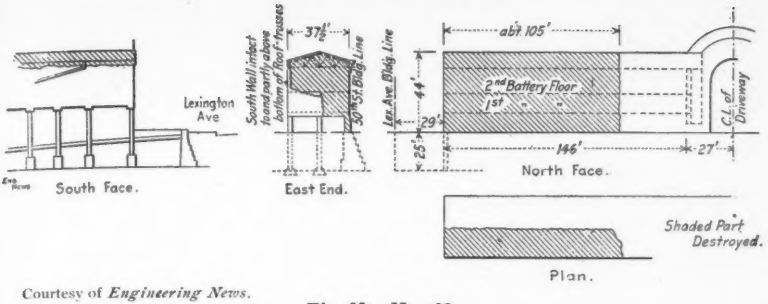
The *Engineering News*, in commenting on the force of the explosion and its effect, gives the following:—

"The even distribution of the damage over the whole of the building affected is characteristic of a gas explosion. Where a charge of dynamite is set off, the destructive effect is greatest in the immediate neighborhood of the explosive and rapidly diminishes away from this center.

"Some incredulity has been expressed in the public prints as to a gas explosion being of sufficient force to do such extensive damage. It is little realized, apparently, what enormous potential energy is contained in even a moderate volume of combustible gas if mixed in proper proportions with air and exploded. A brief computation may be of interest, therefore.

"Suppose we take a volume of 100 cubic feet of gas of 600 B. T. U. per cubic foot calorific power. When mixed with air in the proportions for most violent explosion, the mixture could be contained in a small room about twelve feet cube. The total heat units in this gas would be 60,000 B. T. U. and the total foot-pounds of potential energy would be 60,000 x 772, equaling 46,320,000 foot-pounds. If this gas were exploded in small quantities behind a piston in a gas engine cylinder, something like fifteen to twenty-five per cent of this could actually be obtained as mechanical energy; and given proper mixture, something like this energy will actually be generated when the gas is exploded in a confined or partially confined space and will be exerted against any obstacle. This means that only 100 cubic feet of gas exploding when mixed with air may have a potential destructive power of over 10,000,000 foot-pounds; or it could lift a structure weighing a thousand tons to a height of five feet.

"Of course, under actual conditions in accidental gas explosions, the mixture of gas and air is imperfect, too rich in some places for greatest explosive efficiency and not rich enough in others. It will be appa-ent, however, from the above computation, that even a very few cubic feet of combustible gas mixed with air and fired has potential energy sufficient to cause an explosion of most destructive effect."



Courtesy of *Engineering News*.

Fire No. H-5988.

Diagram of battery house showing extent of destruction.

The surmise has been advanced that hydrogen evolved from the storage batteries accumulated in the battery room and exploded, but the best engineering opinion is that this theory is untenable. A battery such as was used by the New York Central is connected so as to "float on the line," as it is called, that is, it takes current from the line when there is excess of production, and gives it out when the demand is greatest. A battery, of this type is oftentimes overcharged and undercharged, but without any serious injury. One ampere of current per second liberates, theoretically, .00001044 gram of hydrogen. In the storage battery, however, a large part of this hydrogen is absorbed by the plates of the battery, so that very much less than the theoretical amount would be discharged into the air. Where such an infinitesimal amount is liberated, unless closely confined it is difficult to conceive how it could cause explosion. A large engineering corporation operating a considerable number of such batteries much larger than the one in question have never had such an explosion and have never heard of one. Batteries of this kind are used in submarine boats and would not be selected for such use unless considered perfectly safe.

S-9912. Hemp Storehouse. Fire occurred from unknown cause, but probably from smoking, at 2.55 p. m. on the third floor of storehouse No. 38. Storehouse was four stories in height, of mill construction with brick walls; floors seven-eighth inch maple on three-inch matched plank, finished with one-inch of asphalt and some cement, and provided with scuppers for drainage. This floor was full of hemp piled five bales high in a solid block without aisles except at sides of room and a small space at southeast corner where some binders' twine wrapped in burlap was stored.

Storehouse was equipped with a modern sprinkler equipment, consisting of Grinnell glass disc heads installed with pipes about 1895, 1-2-3 schedule of pipe sizes, sprinkler heads spaced eight and a half feet apart on line, one line in each five-foot bay. Sprinkler system was supplied

by a 100,000 gallon gravity tank on a hundred-foot steel trestle, giving forty pounds pressure on sprinklers first opened, supplemented by four 1,000 gallon steam fire pumps. The obstruction to distribution from sprinklers was serious, as the bales of hemp were stored in a solid pile extending from floor to sprinkler piping.

The fire was first seen in the northwest corner of the room by a sweeper and some men who were repairing floor in adjoining warehouse. These men tried to extinguish fire with fire pails while the sweeper sent in an alarm. Fire quickly spread over and between bales, opening eighteen sprinklers. On account of the piling of the stock, sprinklers were unable to extinguish the fire, the water not reaching the bottom of the pile. The mill department and the city fire department responded quickly and extinguished fire in about three hours, using twenty hose streams. The steam fire pumps were run and one fire boat also assisted the city engines.

There was practically no damage to building except that caused by the fire department in ventilating room, nor was there a large amount of stock burned, but the water damage extended over the entire lower tier of bales. The fire apparently assumed a smouldering condition after the first flash was over, burning numerous bales to a depth of two to four inches. This was probably due to the tightly packed strands of hemp and lack of oxygen in the center of the pile. Owing to the congested condition of piling, fire smouldered for more than thirty-six hours or until a second fire broke out on the floor below. The second fire was discovered at 2.35 a. m. on the second floor directly under previous fire.

During the night, following the first fire, extra watchmen were kept in the third story of the storehouse. They had one line of hose with a shut-off nozzle, and as there was a leak in one section of the hose, two of the men went after a new section. On returning to the building they saw fire in the second floor. The line in the third floor was very quickly carried into the second, but as the fire appeared to be spreading a public alarm was given. Fifty-six sprinklers opened promptly, but, as in the previous fire, the water could not do effective work at the bottom of the piles on account of the manner in which the bales were piled. The sprinklers kept the fire down and prevented damage to the building. The fire caused a dense smoke and several of the city firemen were overcome. About twenty hose streams were used, which were supplied by the mill pumps, engines, and two fire boats. The fire was under control in about six hours.

The first and second stories were full of sisal piled five bales high in the second story and six bales high in the first story. The fire extended over most of the second story. The principal damage was from water. The second story was covered with asphaltum and has scuppers for draining, but water leaked through around the posts to the first story, damaging quite a number of bales. Several windows were broken for ventilation and to facilitate the use of hose streams.

As soon as the fire was extinguished, a hundred and fifty men were put to work removing the damaged bales. Racks were built in the yard and stock dried out as rapidly as possible.

After a careful investigation as to the cause of fire, the following conclusions were reached: The cause of the original fire was undoubtedly due to smoking by one of the contractor's employees. While the second fire may have been incendiary, it seems more probable that it was caused by fire smouldering in the bales which were rolled down the stairs from the third to the second floor by the city fire department while extinguishing the first fire. These bales completely blocked the doorway so that it was necessary for the watchman to make his rounds at the other side of the building. Loss, due to both fires, estimated to be from $40,000 to $50,000.

This fire again proves the inadvisability of piling stock in one solid block. If aisles had been provided, fire could have been isolated and extinguished with small loss. As it was, fire spread through the baled stock from one end of the building to the other, and as the fire department could not definitely locate the fire and concentrate the hose streams on that point, a large amount of water was poured into the building at random The fire was not completely extinguished until practically all stock had been removed from floor.

H-5989. Tenant Manufacturing Building. (Newark, N. J.) Twenty-five girls and women lost their lives in the fire which practically destroyed an old four-story brick and joist constructed building. The main building was four stories high with a blind attic five feet high at peak; adjoining sections were one and three stories high. Main building was fifty by one hundred and thirty-two feet in area; walls were of brick; interior construction wooden girders and beams supported by unprotected cast-iron columns. Floors were double, two inches thick, but had been in use since the erection of building and were worn thin. The roof was constructed of composition roofing on boards with a wooden boxed cornice. There was practically no finish on inside walls, but about thirty per cent of the ceiling was sheathed with wood or metal. The one superimposed stairway was enclosed in a double board partition with doors arranged to close automatically. There was one elevator partly enclosed in frame partitions with glass windows; this, however, was of such inflammable construction that elevator was practically open. There were also numerous small belt holes from floor to floor.

The building was heated by steam and lighted with electricity and gas. Steam power was derived from a one-story boiler house adjoining the main building. This boiler house was fairly cut off from the first story of main building. There was no watchman and practically no private protection. There was a good supply of fire pails at last inspection, but fire spread so rapidly as to make such protection entirely inadequate.

Courtesy of *Newark Evening News*.

Fire No. H-5989.

View showing wreck of the Tenant Manufacturing Building, Newark, N. J., in which twenty-five women and girls lost their lives and many were injured.

Main building was equipped with two unreliable and inadequate fire escapes, one on the front of the building and one on the rear. There was an iron balcony covering two windows on each floor with steps inside of window from floor to window sill. These balconies were connected with straight up and down iron ladders so that only one person could start down at a time and these ladders were further located right in front of windows out of which flames and smoke were pouring when their use was greatly needed. During the start of fire one of these ladders became red hot, a veritable gridiron, the use of which was impossible, while the bottom ladder of the other fire escape failed to work through the sticking of a joint or ladder not being properly hooked on so that it could not be lowered and was practically worthless as a means of egress. In the rear, even had escape been possible, there was only a narrow alley difficult of access at such a crisis.

The occupancies of building and hands employed were as follows: First floor occupied for the manufacture of paper boxes, employing about thirty people and by a machine shop employing about sixteen people; second floor, manufacturing of paper boxes, employing about fifty people; third floor, assembling incandescent electric lamps, employing about seventeen people, fire starting on this floor; the fourth or top floor was occupied for manufacturing underwear, employing from seventy-three to one hundred and fifteen people. Most of the employees in building were girls and women, there being only a few men employees in the building outside of the machine shop.

Fire occurred in this building on Saturday, November 26th, when the structure was practically destroyed, many lives lost and a large number injured. Starting on the third floor in the plant of the incandescent electric lamp factory, it spread to gasolene present and was immediately beyond control.

There appears to be little doubt that the fire was caused by upsetting a can of gasolene belonging to an apparatus for re-carbonizing the filaments of incandescent lamps. The filament to be re-carbonized was looped and connected with two poles supported in a vulcanized cork or stopper which was placed in the mouth of a small metal can. A small iron pipe connected this can with the can of gasolene on the floor near the workbench, and the opposite side of the can on the table was connected with a vacuum pump. The air was first exhausted from the carbonizer, then the vapor from the gasolene was allowed to enter the carbonizer, and finally an electric current was sent through the filament in the carbonizer.

How the gasolene ignited the first time is not definitely known. The girl's shoe may have made a spark by striking a nail in the floor. A small electric motor was running in the room at the time, variously said to have been from twenty to fifty feet from the gasolene.

The main supply of gasolene for this process was kept in a barrel in the factory yard, and a supply was brought in several times a day in a

Courtesy of *Newark Evening News.*

Fire No. H-5989.

Only portion of front fire escape remaining.

Courtesy of *Newark Evening News.*

Fire No. H-5989.

View of rear fire escape after fire.

gallon can. The supply can for the apparatus held about two quarts. This can had just been refilled by the girl in charge. When she saw the burning gasolene spreading over the floor she called for help. To get any sand a trip had to be made up the spiral stairway to floor above. That alone gave the flames ample time to spread. Two pails of sand were thrown on the blaze by an employee. The sand seemed to extinguish the fire, but apparently it only smothered it, for it suddenly flashed up a second time and quickly jumped to the ceiling.

Work of that description was not of a character to be intrusted to inexperienced girls or to be carried on in such an old tinderbox of a fire-trap. To extinguish gasolene flames either chemicals or sand should be employed. Neither were on hand, as surely would have been the case if experts had been employed as these girls were. One was already badly burned and thereby was hardly capable of action even if the sand or chemicals had been lying beside them ready for use.

A fire station was directly opposite the building. Instead of immediately giving the alarm, the foreman, the girls assisting him, tried to smother the flames with sand. With the rising flames spreading fiercely round them, they found it impossible to do what possibly might have been done a few minutes before when the fire was in the incipient stage. Finding their endeavors vain, a fireman who was standing outside the station was beckoned to, and he, not knowing the true state of the case, ran across with a chemical extinguisher Too much time, however, had been lost and the flames had gained great headway. The fireman rushed back to the house of engine 4 and turned in an alarm. The first alarm was received at 9.26 a. m., followed by a telephone call at 9.29 for a special truck from fire house across street from the fire. At 9.32 a second alarm was sent in and at 9.43 the third alarm was given. Although a fire engine company was directly opposite and was in its quarters at the time, the fire gained a great hold on the two upper stories before the first line of hose could be stretched. Before any water was thrown, the fire burned its way into the concealed spaces in the joisted floor, and each time it came through the sheathing it is said that there was a flash and a noise like an explosion.

The flames spread quickly through the building, at once creating a panic. The employees on the ground and second floors escaped without much trouble; some even on the third floor managed to reach the street in safety. With the hundred employees on the fourth floor it was very different. Choking and blinded by the smoke, they groped to find a means of exit. They tried the stairway but were driven back by the suffocating fumes of gasolene and smoke combined and many of the girls were forced to jump from the fourth story windows into the street. Others were overcome by smoke and died in the building. The fire spread so rapidly that the girls could not be prevented from jumping before arrival of the ladder trucks. Some rushed to the one miserable pretense of a fire escape near the end of the building, as some from the lower floors had

escaped at that end, but the looped-up fire escape ladder had become too hot to handle and they had to be gotten down by means of a stepladder. At the rear of the building was the narrow, straight-up two-story fire escape, running down past the windows out of which the flames were issuing which had heated the ladder red hot.

Had the employees only stayed where they were they would have been rescued by the firemen, who by this time were raising the long ladders—a work of difficulty at the end of the building, on account of the narrow alley—and were extending the life nets to catch the girls if they jumped.

The firemen directed all of their efforts toward saving the women in the building and the fire was not checked until the building had been completely destroyed, with the exception of portions of the outside brick walls. It is reported that the dangerous condition of the building had been for some time widely known, although it had recently been passed as complying with the New Jersey State laws by Deputy Factory Inspector.

The building was built fifty years ago and was thoroughly saturated with oil. The flames spread very rapidly and cut off escape down the stairway from the fourth to the third floor before the employees on the fourth floor were aware of the danger.

The coroner's jury which investigated the holocaust, it is stated, was compelled to find that no one was to blame for the great loss of life even with the acknowledged deficiencies in fire escapes, overcrowding of the old fire trap and lack of facilities for escape of employees in case of fire. The allowing of the building, unfit for either factory or residential occupancies, to be occupied for the several hazardous occupancies employing the large number of girls and women—with the most hazardous occupancy on the third floor under the manufactory employing over one hundred women at time fire occurred—is grossly criminal.

The superseding of the city ordinance by the action of State Legislature which lowered the standard for protection of life and property and made such a verdict possible is not in accord with progress. Had either the city ordinance or state laws been intelligently enforced, however, the protection given would have eliminated the possibility of such a holocaust.

Fire Causes.

The fires here given are selected to illustrate defects, either of construction or superintendence, in the classes of property indicated.

S-4224. Manufacturing Celluloid Hair Ornaments. Fire occurred in the drying room, being caused by a celluloid pin which dropped through a crack in the wire netting onto steam pipes below.

Wire screen should be frequently inspected and kept in repair.

H-5623. Agricultural Implement Works. Fire was caused by a spark at motor which ignited benzine vapors, flashing fire to a large dip tank nearby. Dip tank was sunk in the earth and equipped with metal covers. Motor was of the open type, located about eight feet away from tank and used to operate an agitator or churn in the bottom of the tank. Paint mixture at time of fire consisted of a mixture of lead, oils and benzine. This burned with such intensity that covers could not be placed on tank and fire rapidly spread throughout the room.

No electric motors or switches should be installed in rooms where inflammable vapors are present. If artificial lighting is necessary, vaporproof double globed electric lights should be installed and controlling switch should be located outside of room.

Covers should be hinged to tank arranged to operate automatically, being held open by a fusible link.

H-5665. Sheet Metal Worker. A five gallon can of gasolene was stored in the office. The proprietor lighted his cigar and then threw the blazing match near the can. Loss $20,000.

Carelessness.

H-5675. Manufacture of Wire Cloth. The paint tower in which fire occurred was eight stories in height, first floor of brick construction, remainder frame, and was occupied for the painting or dipping of wire cloth, the cloth being run through paint tub at bottom of tower, then over rollers in tower to dry. Paints were thinned with benzine and naphtha. Fire occurred in paint tower, caused by the bursting of an incandescent

light bulb, which ignited the inflammable vapors. This was probably due to the failure of a fuse to blow on overload.

Only double globed vaporproof lamps should be used and the lighting system should be protected by standard fuses accurately rated.

H-5686. Art Pottery. Fire was caused by a brick trial kiln mounted on the wooden floor of second story of factory section. The protection over floor was insufficient and kiln overheated and ignited floor. Loss $24,000.

H-5710. Clothing Factory. Electric current was left on pressing irons at closing time, the irons resting on cloth-covered pressing boards. Fire occurred at 4 a. m., due to overheating of irons and ignition of pressing boards.

Ventilated metal rests should be provided for irons.

A pilot light should be installed at main switch controlling all irons in room. No excuse can then be offered for leaving current on circuit.

H-5725. Garage. One employee was cleaning an automobile with gasolene while another was using a gasolene blow torch about fifteen feet away. The flame from blow torch ignited the gasolene vapors, which flashed fire to the container, causing an explosion, flames instantly enveloping the automobile. Auto was pushed out of building, so there was no fire damage to structure, although two of the brick sides of the building were partially wrecked by the explosion.

Ignorance, carelessness.

H 5747. Rubber Works. Fire occurred in the shed in yard used for the storage of crude rubber and various chemicals and compounds. Employee is said to have been pouring some bi-sulphide of carbon from supply into a small can, to be used for dipping hard rubber goods, when the contents suddenly took fire from unknown cause. Filling was supposed to have been done outside of shed in the open. This rule will be enforced in the future.

H-5775. Brewery. Fire was caused by an employee bringing an open torch near vats which had just been varnished, the inflammable vapors from the varnish causing an explosion in one of the vats.

The varnish used for coating vats consists mainly of shellac cut with alcohol. This is applied to the interior of the vats with brushes, and as the alcohol vapors are always present during the varnishing, all open lights should be prohibited. Explosions have occurred from the ignition of these vapors by open lights which have resulted in fire and loss of life.

If artificial light is necessary, keyless socket vaporproof incandescent lamps should be used.

H-5812. Paint Factory. Fire was caused by the boiling over and igniting of a roof-compound which was being heated by gas flame under kettle.

Boiling kettles for the manufacture of roofing compounds having inflammable ingredients should be heated by steam. If this is not practicable heating furnace should be arranged to fire from an adjoining room—room in which kettle is installed to be fireproof. In no case should an open flame or gas jet be used.

H-5813. Foundry. The exhaust pipe from gas engine was located too near to wooden partition, and the heat ignited sill where the exhaust pipe passed under partition from engine to outside of building.

Exhaust pipe, whether direct from engine or from muffler, to extend to the outside of the building and be properly supported at least six inches from any woodwork or combustible material, and if run through floors or partitions, to be provided with ventilated thimbles at least six inches larger in diameter than the pipe; and the vertical portion of a pipe that passes through a floor to be covered with approved non-combustible material.

H-5830. Motion Picture Theatre. Fire occurred in the motion picture booth on second floor during exhibition. Booth was constructed of asbestos lumber with self-closing slides at openings, in accordance with the municipal law.

The operator placed the wrong film in machine and in his hurry to change to the right one, it came in contact with the arc light and ignited, setting fire to the film on the re-winding machine and the one in the machine box which was open. Operator immediately broke strings operating self-closing slides, which prevented the smoke and flames from penetrating the auditorium. The fire was then extinguished by a fire extinguisher. The booth was not damaged nor was the building or contents other than the three films in booth, proving the value of the modern fire-resistive booth for motion picture machines in case of fire.

H-5832. Cotton Belt Manufacturing. The belting after passing through heated tar in tank passes between metal rolls which are heated by gas. Gas jets ignited the tar adhering to rolls.

If rolls were heated by steam, this hazard would be eliminated.

H-5869. Cereal Mill. Fire occurred on the roof of the main mill building from crossed electric wires on a large electric sign. Sign was

constructed of large wooden letters, wiring open, knob and tube work exposed to the weather, installed two or three years ago, so that the insulation could have easily deteriorated and become defective. City fire department was handicapped by lack of water, and loss amounted to $45,000.

Electric signs should preferably not be installed on roofs and should be positively prohibited from combustible roofs.

Signs should invariably be constructed of metal.

S-10284. Shoe Factory. Floors had been oiled and the oily waste thrown into an open waste barrel. This ignited spontaneously about 3 a. m., opening one sprinkler and causing a loss of approximately $2,000.

Only self-closing approved waste cans should be used. Oily waste from oiling floors should be taken at once to boiler room and burned and not placed in waste cans.

S-10317. Clothing Factory. Employee left gas burning in pressing iron when leaving for the night. Iron became overheated, setting fire to some cloth nearby.

If gas system were equipped with a pilot light controlled by the main shut off valve for room, the possibility of gas being left burning in irons would be eliminated. This light should be located at side of room on a rigid fixture near master valve and where it will be well away from shelves or combustible material. This will also insure the shutting off of the entire system at closing.

S-10402. Saw and Planing Mill. Fire was caused by the ignition of dust and shavings which had accumulated around exhaust pipe from gas engine.

Exhaust pipe from gas engine is liable to become very hot and should be efficiently protected where dust or inflammable flyings are present.

S-10409. Woodworker (Sash and Door). Power in this portion of the plant was derived from a 35 horse power, 110 volts motor, located on a wooden platform suspended from the ceiling. Tenants were careless in housekeeping, and pipes, motors and platform were generally heavily coated with wood dust, etc., and at the motors this would be more or less saturated with oil.

While sawing a piece of timber, the power suddenly gave out and employee saw a flash at the motor, the accumulation of dust immediately taking fire. One sprinkler opened and extinguished the fire. The probable cause of fire was the sparking at commutator of motor, due to overloading. It was stated that the fuses were not blown.

Points of Interest from Fire Reports.

These notes are intended to illustrate the efficiency or inefficiency of signaling, retardant or extinguishing agencies.

Alarm Service.

S-4597. Foundry. Fire was caused by the clogging and overheating of a poorly insulated metal flue leading from crucible furnace through the frame wall to an outside brick stack. This frame wall was in contact with the metal flue.

Watchman heard sprinkler alarm bells ringing and discovered fire burning on the outside of the frame wall, sprinklers having practically extinguished fire on inside where the water could reach it. Watchman completed extinguishment with a chemical extinguisher.

The action of the sprinklers and alarm undoubtedly saved the building from a total loss, as it is located some distance from plant, and watchman would probably not have discovered fire until it was beyond control.

S-10345. Bolt and Lock Factory. Fire occurred at 10.10 p. m. Plant was without watchman service. Outsiders heard the sprinkler alarm and gave alarm to public fire department. One sprinkler had opened and practically extinguished the fire.

S-10383. Tenant Manufacturing. Building was equipped with old unapproved sprinklers under light and deficient water supplies. Sprinkler system was equipped with a Grinnell alarm valve in conjunction with a system of Watkins modern thermostats connected with central station. Thermostatic and sprinkler alarms were received at the central station practically at the same time. The fire department was immediately notified and arriving at building found the fire under control but the water supply to sprinklers practically exhausted.

S-10388. Woodworker. Building was equipped with thermostats connected with fire department and a sprinkler alarm connected to rotary gong. Thermostats operated efficiently and notified fire department. Superintendent living nearby heard the sprinkler alarm and had the doors unlocked for fire department by the time they arrived.

S-10389. Woolen Mill. Sprinkler system is supplied by two independent waterworks supplies, the alarm service being installed on only one supply. This supply was shut off at time of fire so that buildings were without alarm protection.

The Rules and Requirements regarding alarm service for Sprinkler Equipments as recommended by this Association state that for the greatest protection alarm valves are to be installed as follows:

Section G-2. Alarm Valve. To be so located that the passing of water through any of the automatic sources of supply to any of the sprinklers will cause its action.

To accomplish this in some equipments it will be necessary to use two or more alarm valves.

S-10391. Jewelry Factory. Building was equipped with automatic sprinklers and sprinkler alarm. The watchman failed to discover fire, but an outsider heard sprinkler alarm operating and pulled city fire alarm box.

S-10416. Bakery. Sprinkler alarm notified watchman of operation of sprinkler system. He ran to fire department house and gave alarm.

Automatic Sprinklers.

S-1284. Shoe Factory. Fire of incendiary origin was started outside of the sprinklered building in an adjoining open shed where some leather scraps were stored. Fire had gained considerable headway when discovered, ultimately burning through the frame exterior wall on the first floor of sprinklered building and opening two sprinklers which did efficient work, holding fire in check and preventing it from spreading into building.

S-10327. Laundry. Fire was caused by goods being piled against an incandescent gas lamp in the storeroom. One sprinkler opened and extinguished the fire. As the wareroom was filled with light inflammable material, the fire would have rapidly spread over the contents of room and to the wooden construction of building but for the prompt and efficient service of the sprinkler system.

S-10383. Tenant Manufacturing. Fire occurred from unknown cause at 6.45 p. m. on the fifth floor, occupied for the manufacturing of ruching. Room was protected by a system of old type Manufacturers' No. 2 sprinklers, on wet system, supplied by a gravity tank of limited capacity, giving seventeen pounds pressure on sprinklers first opened.

The stock was of a light and inflammable nature and flashed fire rapidly over premises and storage bins. These bins also proved considerable of an obstruction to sprinkler action. Thirty-nine of the fifty-two sprinklers in room were opened. The links on several sprinklers fused but did not open. This was probably due to the light water pressure. After the fire, the heads which had not fused were taken out and tested and it was found that a few were 300° heads, including one head nearly over the point where fire is supposed to have started. Upon test all heads opened.

Tank was found empty after fire, but the sprinklers without question protected the building, which sustained practically no damage, and held the fire under control until arrival of fire department.

Old obsolete sprinkler systems should be reconstructed, new approved heads installed and brought up to standard.

S-10384. Theatre. The fire was caused by electric light wires in the floor of the auditorium at a point where the horizontal floor joists and the slanting raised section intersect. The concealed space between the two floors, except at this intersection of the joists, was thoroughly covered by the sprinklers, and these operated and confined the fire to that space. The ceiling under the joists being constructed of pressed steel, prevented the sprinklers in the room below from extinguishing the fire. Seven sprinklers opened and held fire in check with a loss of approximately $4,000.

Extend sprinkler system to cover all portions of concealed space.

S-10397. Cotton Ginnery. Fire occurred in gin stand and was blown through conveyor tube to condenser, spreading down into press. There were no sprinklers in the condenser, but the sprinklers over press operated promptly, preventing fire from spreading over ginnery.

Condenser heads should be equipped with automatic sprinklers.

S-10415. Brush Factory. Fire was caused by the boiling over of a kettle of rosin. Two sprinklers opened and entirely extinguished fire, doing excellent work. The inside of the small room was badly smoked and charred except on the ceiling around sprinklers, showing that sprinklers operated at once, controlling and extinguishing the fire.

S-10421. Starch Mill. Fire was caused by spark in an elevator leg. This ignited the fine dextrine, causing a flash and explosion, throwing fire out into basement, first and second floors. This opened twenty-five sprinklers supplied by a steam pump under 120 pounds pressure, which entirely extinguished fire with a loss of but $2,000.

Chemical Extinguishers.

S-1819. Bakery. Fire was caused by a chimney fire which blew burning soot and flame out through the clean-out hole when same was

opened. This ignited the floor joists and bridging between, but employees easily extinguished same with chemical extinguishers.

Construction.

H-5454. Dye Works. Fire was caused by the steam coils in stock dryer on the top floor of two-story brick building. Dryer was of wooden construction, forty feet long and eight feet high, which brought the top of dryer to within a few feet of the unprotected iron roof girders. Dryer and contents were practically destroyed, the heat twisting the roof girders and causing them to collapse.

Building was of brick construction, floors covered with cement. Section containing dryer was well cut off with fire doors, which were effective in preventing the lateral spread of fire; the roof, however, was combustible on unprotected iron girders, which soon collapsed through the heating and softening of the iron. Roof girders could have been efficiently protected by covering with wired lath and cement plaster or other resistive insulating material. Unprotected iron girders are more susceptible to immediate collapse and injury than heavy mill construction.

H-5463. Metal Worker. Boiler flue was being cleaned when some of the glowing soot was drawn up the chimney by the draught, falling onto the roof of forge shop, igniting roof where some of the slates were displaced.

Slate roofs in good condition are efficient protection against sparks. Frost, however, is liable in time to loosen the slates, and roofs should be frequently inspected.

H-5692. Metal Worker. Building was old, of frame construction, three stories in height. The floors had settled considerably in the third story and had been leveled by laying new flooring upon the old, leaving a small concealed space between the floors. Fire originated and burned in this concealed space from unknown cause.

Poor construction.

H-5804. Tenant Manufacturing. Fire started from unknown cause in a passenger elevator car at first floor landing. The elevator shaft was constructed with three brick sides, the fourth side being enclosed with wood and glass doors. Fire spread slightly through this side on the first, second, third and fourth and quite a little on the fifth and sixth floors.

Elevator shaft should be entirely enclosed in an improved manner.

Fire Doors.

H-5464. Paper Mill. Fire started in baled waste paper stock on the top floor of finishing building. Building was of brick construction, with good automatic fire doors which operated and held fire from spreading. There were, however, openings in wall over fire door at north end of room and fire spreading through these openings ignited roof of adjoining section.

All openings through fire wall should be securely stopped.

H-5675. Manufacturing Wired Cloth. By having the extra hazardous process, paint mixing and painting, well cut off from remainder of plant, a destructive fire was probably avoided. The fire door at tower end of passage to main plant operated promptly and confined fire to the section in which it originated.

Fire Shutters.

H-3001. Waste Storehouse. Fire originated in and totally destroyed waste storehouse, also destroying seven houses nearby as well as proving a severe hazard to adjacent buildings. At the end of storehouse, twenty-five feet distant, there was a large four-story warehouse containing leather skins. Window openings on this building were protected by bare wooden shutters. These were ignited by the heat, but with the assistance of fire department held fire from entering building.

Approved tin-clad shutters only should be used on window openings adjacent to severe exposures.

Fire Walls.

H-5788. Foundry. Main foundry building was of light frame construction with a substantial brick fire wall at westerly end, the only opening through this wall being protected by a standard automatic fire door. The frame portion of building was totally destroyed and considerable damage resulted to the brick additions. The fire wall and door gave excellent service in confining fire to this section and prevented what might have been a serious loss.

H-5809. Grain Elevator. Building was of good brick construction with two transverse division walls parapetted twenty-four inches, with standard automatic fire doors at openings on all floors.

Fire originated in a small grain blending machine on second floor, burning rapidly and spreading into grain bins, which practically extended from third floor to basement. The burning grain gave off a dense smoke, almost smothering three firemen and making a stubborn fire to fight. Fire was confined to the floor on which it originated.

Fire illustrated the effectiveness of good fire walls with standard automatic fire doors. Fire doors operated properly and confined fire to the point of origin. But for this protection fire would have undoubtedly spread into elevator and wrecked the entire building. Loss about $15,000.

S-10423. Piano Factory. Block in which fire occurred consisted of two six-story and basement buildings, separated from each other by a blank brick party wall parapetted about two feet with a stone coping. Fire started in the adjoining building, exposing the piano factory through this fire wall. The fire in exposure ignited the roof of piano factory near the fire wall, and roof was torn up for about half a foot alongside of fire wall to prevent fire from spreading. The only fire entering factory was on the fourth floor, where it evidently burned through at the sill of a former door opening which had been bricked up. Heat also ignited the ends of some floor beams which either extended through the party wall or which did not have proper thickness of wall for protection on the exposure side.

The value of a blank parapetted party wall was strongly emphasized. There were previously door openings on various floors, but these had been bricked up. The danger of supporting beams extending through fire wall or too far into same to allow of proper protection was emphasized.

Floor Openings.

H-5444. Woodworker. Fire was caused from spontaneous ignition in the shavings vault, fire spreading to upper floor through a large metal refuse chute which was equipped with hinged metal covers at openings on each floor. The cover at opening on the fourth floor was entirely off, and fire spreading through this opening destroyed about one half of the roof. Direct opening to vault on first floor was closed by a poorly constructed iron door. This allowed heat to escape, igniting lumber nearby, fire also spreading up the wall, charring the ceilings on first, second and third floors.

Build a standard, well ventilated shavings vault and protect all openings by double automatic drop coverings.

H-5621. Mercantile. A light shaft of combustible construction extended from the basement to the roof of the three-story building. Fire starting in the basement entered this light shaft which acted as a flue spreading fire to all floors and carrrying flames high above the roof of building. There was no private protection and fire was finally extinguished by the public fire department after a fight of eighteen hours. Loss $161,100.

Light shaft should be constructed of brick or other fire-resistive construction. All lights at bottom if not of thick glass prisms set in substantial cast-iron frames, should be either of standard wired glass not less than one-quarter inch thick, or one-half inch thick glass protected with approved wire screens. Sash and frames to be constructed entirely of metal.

The tops of all open shafts should be protected by galvanized steel wire cloth screens. If shaft is covered with a skylight not over one-eighth inch glass should be used either on top or at sides and this should be protected by suitable wire screens.

H-5727. Garage. Garage was of ordinary joist construction with open stairway and brick elevator shaft not equipped with fire doors. Fire was caused at 2.30 p. m. by a chauffeur who left his car on the first floor without making sure that all conditions were normal. Two employees washing autos nearby saw smoke rising from auto and attempted to extinguish the fire with pails of water. Before the alarm could be given the gasolene tank of auto exploded, scattering burning gasolene in all directions. Fire rapidly spread through the open stairways and elevator shaft to upper floors, fire not being controlled until after nearly two hours of fighting. Loss estimated at $150,000. One employee was unable to escape from the burning building and eight persons, including three firemen, were also injured during the fire.

Stairways in hazardous occupancies should be enclosed in brick shafts. If the erection of the brick shaft is not practicable in old buildings, well constructed wired lath and plaster partitions could be used or stairway enclosure could be built of two thicknesses of match boards or of tongued and grooved or splined planks. All openings should be closed with standard fire doors. It is preferable to keep doors closed at all times, but where necessary to be kept open during working hours, doors can be weighted to close automatically and held open by a hook attached to a fusible link located as high on door as convenient.

Had the elevator shaft been equipped with fire doors and the stairway properly enclosed, the rapidity and vertical spread of fire would have been greatly retarded, allowing the escape of employees on floors above.

H-5766. Warehouse. Fire had not spread above first floor upon arrival of fire department, but before controlled rapidly spread to the third floor through the frame elevator shaft.

H-5772. Mercantile. Building was six stories and basement in height, occupied by dealers in hardware and hardware supplies. Fire started in the basement, spreading up the open elevator shaft, communicating to all floors and was bursting through the roof when discovered by an outsider. Building was one of the best and most substantially built blocks of its type, and had elevator been enclosed or trapped, fire would have been confined for a long time to point of origin. Loss $131,000.

Building was of mill construction, built for strength and fire-resistance, yet one of the features most conducive to spread of fire and interior exposure, floor openings, had been overlooked and remained a menace to the entire building and contents, as was proven by the rapidity with which

fire spread. Vertical openings through all floors of a building act as flues in time of fire, furnishing a draught to fire which is equal to a giant chimney. If the record of increased loss due to these unprotected vertical openings was available, it would be evidence startling enough that protection to floor openings is necessary to safeguard the rapid spread of fire and the holocaust which so often accompanies it.

H-5778. Mercantile. Fire originated in rear of first floor and spread up elevator shaft to floors above. Elevator shaft was equipped with traps, but these were inoperative owing to location of the elevator. City fire department fought fire for about two and a half hours before extinguishing same. Loss adjusted at $40,174.

H-5824. Mercantile. Fire started in basement, due to an overheated furnace, spreading throughout upper floors through an open elevator shaft. Loss approximately $50,000.

Open elevator shafts and hatchways should be provided at each floor opening with a trap door which opens and closes as elevator passes through. When trap door is closed it should extend beyond opening on all sides.

S-6868. Saw Mill. Fire occurring from overheated bearing on line shaft under floor of lath mill spread quickly to floor above through unprotected belt openings. Twenty sprinklers opened and practically extinguished the fire.

Five per cent of the unsatisfactory sprinkler fires in the records of the Association were caused from vertical openings, faulty building construction, concealed space, etc. The maximum sprinkler efficiency cannot be expected in buildings where sprinklers are at a disadvantage owing to vertical openings, poor construction or concealed space, which allows the rapid spread of fire from one section to another.

Obstruction to Distribution.

S-10342. Paper Mill. Fire occurred from an unknown cause under the hood or in the pit of a paper machine. This proved a severe obstruction to the distribution of water from sprinklers nearby and fire destroyed frame hood and damaged roof.

All hoods over paper machines should be equipped with sprinklers. This will prevent fire from spreading through the ventilating flue.

Private Protection.

S-2005. Leather Factory. Fire started from an unknown cause near a cold air fan ventilating section used for leather drying on top floor. This was discovered by employee before spreading to any extent, and was at once extinguished with fire pails and standpipe hose streams before sprinklers opened. Loss $70.

H-5430. Furniture Factory. Watchman, engineer and employees living nearby used three hose streams supplied by fire pump on fire, holding same in check until arrival of public fire department.

H-5649. Foundry. Watchman with assistance of employees used inside and outside hose service, checking fire and doing much towards its extinguishment. Public department responded promptly, but were delayed nearly thirty minutes before the fire engine could be started and hose streams put into service.

H-5680. Fertilizer Plant. Fire was fought by the private brigade with hose streams from hydrants supplied by the fire pump. Early in the fire the packing of a joint in the main blew out, putting the system out of service. The boiler and engine house was saved by the fire department, but the fertilizer building was destroyed. Loss $50,000.

H-5688. Electric Light and Power Station. Fireman noticed that the roof of boiler house around the iron smokestack was afire. He gave alarm and employees with small hose practically extinguished fire before arrival of fire department.

H-5751. Metal Worker. Fire occurred in ventilating duct from hardening-furnace and oil-tempering bath. Employees gave alarm and private brigade extinguished the fire with hand chemicals and a hose stream before public fire department arrived.

Install separate ventilating duct for each process. Residue is liable to collect in duct from the oil tempering process and is easily ignited.

Public Department.

H-5869. Cereal Mill. There was no private protection and the public fire department were forced to fight fire under great difficulties, owing to the lack of water in this district. The shortest hose line possible to use was about six hundred feet long, and it was owing to the powerful stream from the fire boat that enabled the department to control fire. It was necessary for fire boat to lay nearly eight hundred feet of hose in order to reach fire.

Spread of Fire.

H-5662. Warehouse. Fire originated from unknown cause on the second or third floor of three-story and basement brick warehouse building. Basement and first floor were used for the storage of commercial goods, the second and third floors for the storage of household goods. On the first floor, in the rear of the building, was stored from a car and a half to two cars of calcium carbide in 100 pound cans.

The first knowledge of the fire department of the presence of calcium carbide was an explosion, presumably when the water first came in contact with the carbide, which threw the carbide in every direction, spreading

fire throughout the building; burning and blistering the firemen, fifty-three being injured during the fire.

Chemicals had no effect and water only added to the explosive hazard and severity of the fire, explosions occurring at intervals until all the carbide had either burned itself out or been removed from the building. By the use of long hooked poles the carbide was removed one can at a time and fire finally extinguished.

The chief of the fire department states that had it not been for the calcium carbide stored in building, the fire would have been extinguished without trouble insead of necessitating fire department service for nearly two days and nights. Loss large.

The criminal negligence of the property owner and municipal authorities in allowing an explosive material to be stored where it could and did endanger the lives of the public and fire department is abhorrent.

(See rules for the storage of calcium carbide.)

H-5700. Plate Glass Works. Fire occurred from unknown cause at 6.15 p. m. in the motor pit under a grinding table. Buildings were of frame construction, large area, with no fire stops. All buildings, with the exception of power house, machine shop and a few detached small buildings, were destroyed.

Private hose streams were used, but owing to the dense smoke the exact location of fire was not immediately ascertained and flames rapidly spread through the enormous frame areas. Fire was checked for a few minutes at fire wall to warehouse but soon broke through. Pump was in service until about 7.45 p. m. when heat and smoke drove the men from the power plant. Four hose companies and a number of volunteers responded from a neighboring city but were of little assistance, as fire had gained such headway during the first few minutes.

Plant should have been divided into several fire areas by good brick fire walls, all openings in same being closed by approved automatic fire doors.

H-5794. Woodworker. Building was two stories high, of open joist construction, floors in part of slatted construction; vertical openings unprotected. The rapid spread of fire was due to the slatted floors, unprotected floor openings and the large amount of combustible material resent. There was no private protection, and the volunteer fire department was totally inadequate under the circumstances.

H-5808. Metal Worker. The chief cause for fire getting beyond fire department control at the start was due to the large amount of inflammables at point of origin in paint shop, in connection with the light construction of building with large area unprotected floor openings. Building was totally destroyed. Loss approximately $95,000.

Paint shop and other hazardous processes should be located in detached, well constructed buildings, protected exteriorly in such a manner

as not to prove a severe hazard to adjacent buildings. The hazard of fire is always present where paints mixed with linseed or other easily oxidizing oils or with naphtha or gasolene are used, and these rooms should be equipped with automatic sprinklers supplemented by chemical extinguishers and pails of sand.

Steam Jets.

S-2137. Manufacturing Gutta-percha Golf Balls. Fire occurred from unknown cause in the room used for re-distilling or rectifying the used or dirty gasolene. The gasolene was distilled in a large tank, vapors being condensed in another tank from which it was drawn into an ordinary ash barrel. Ash barrel was fitted with a cover, a hole being provided in the cover for filling. It was then emptied into a pipe connected with the outside storage tank. Fire occurred while employee was filling this barrel from condensing tank. There was a sudden burst of flame and employee rushed from building, closing the doors and opening the steam jet. Room was also equipped with two automatic sprinklers connected with steam supply. These with the steam jet entirely extinguished the fire, the only damage being the cracking of a few panes of wired glass and charring of two roof joists.

H-5454. Dye Works. The drying enclosure located on top floor was of wooden construction, forty feet long, eight feet high, leaving a slight space between top of dryer and roof; was divided into sections, each section heated by steam pipes attached to the sides. These dry boxes were equipped with live steam jets which operated at time of fire but without any noticeable effect. The failure was due to the rapid escape of the steam through the ventilators on top of drying enclosure.

The efficiency of steam jets for fire extinguishment lies in the confinement of the steam and its smothering effect on the fire, depriving it of the life-giving oxygen. Drying enclosures, equipped with steam jets, should be arranged so that they may be tightly closed at time of fire.

H-5683. Cotton Mill. Fire occurred from unknown cause in cotton in the opening room. The smoke was so dense that the employees were forced from the room before they could use the small hose. The doors were closed and a three-quarters inch steam jet, with which the room was equipped, turned on. This smothered the fire, extinguishment being completed with a small hand hose stream.

H-5825. Bag Drying and Repairing. Fire originated in a steam heated bag dryer, due to overheating. Installed at each side of the dryer was a two-inch steam jet. The engineer, who had only been in charge for a few days, **had not been instructed in regard to the use of the steam jets, and when fire occurred jets were not used.**

Employees should be particularly instructed with reference to all fire protection appliances, location of fire escapes, etc.

Specifications, Rules and Requirements

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National Board of Fire Underwriters

UPON RECOMMENDATION OF

THE NATIONAL FIRE PROTECTION ASSOCIATION, THE CONSULTING ENGINEERS, AND THE UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION.

SUBJECTS.	Last edition.
Acetylene Gas Machines and Storage of Calcium Carbide	1910
Coal Gas Producers (pressure and suction systems)	1908
Electric Wiring and Apparatus, Installation Rules (Nat'l Electrical Code)	1909
Electrical Fittings, List of Approved	April, 1910
Fire Departments, Private	1902
Fire Doors and Shutters	1908
Fire Extinguishers, Chemical (for other than fire department use)	1909
Fire Hose, for fire department use	1909
Fire Hose, for private department mill yard use	1909
Fire Hose, Unlined Linen, for use inside buildings	1909
Fire Pumps (steam)	1908
Fire Pumps (electric)	1904
Fire Pumps (centrifugal)	1909
Fire Pumps (rotary)	1909
Gas and Gasolene Engines	1910
Gasolene Vapor Gas Lighting Machines, Lamps and Systems	1910
Gasolene Vapor Stoves, for cooking and heating	1903
Grain Dryers	1901
Gravity Tanks	1910
Hose Couplings and Hydrant Fittings, for public fire service	1908
Hose Houses, for mill yards	1905
Incubators and Brooders	1908
Kerosene Oil Pressure Systems	1902
Lightning, Protection Against	1907
Nitro-Cellulose Films (storage and handling)	1910
Oil Storage (fuel), storage and use of fuel oil and construction and installation of oil burning equipment	1902
Oil Storage (inflammable), systems for storing 250 gallons or less of fluids which at ordinary temperatures give off inflammable vapors	1904
Oxy-Acetylene Heating and Welding Apparatus	1910
Railway Car Houses (storage and operating), Construction and Protection of	1907
Signaling Systems, used for the transmission of signals affecting the fire hazard	1907
Skylights	1906
Sprinkler Equipments, automatic and open systems	1910
Steam Pump Governors and Auxiliary Pumps	1908
Uniform Requirements ("slow-burning" construction, "inferior" construction, general hazards, oil rooms, general protection, stairway and elevator closures, watchmen, thermostats, etc.)	1911
Valves, Indicator Posts and Hydrants, for mill yard use	1910
Waste Cans, Ash Cans, Refuse Barrels, Fire Pails and Safety Cans for Benzine and Gasolene	1903
Wired Glass and Metal Window Frame Construction	1906
Underwriters' Laboratories, general information in reference to the nature of its work and the terms and conditions under which tests of fire appliances and materials are conducted	1909

A copy of each revised edition of the above pamphlets is mailed to members of the National Fire Protection Association on publication. Members desiring additional copies may obtain the same, without charge, by addressing the Secretary.

Approved Devices and Materials.

There are listed below in form convenient for reference by members the names and addresses of manufacturers of devices and materials which have thus far been favorably passed upon by the Devices and Materials Committee, following examinations, tests and recommendations made by Underwriters' Laboratories, Inc.

The Laboratories have also issued reports giving ratings unfavorable to a large number of appliances. A summary of the findings in each case can be obtained by addressing the Laboratories and any Active or Associate member can receive regularly the cards issued by the Laboratories giving summaries of the results obtained in the current work in all of its departments upon payment of the subscription price of fifteen dollars ($15) per year.

In the lists which follow members should note particularly that in those industries to which the label service has been extended (indicating inspection of goods by Laboratories' engineers at factories before shipment) **only such of the product of these factories as bear the labels referred to** are covered by the endorsement of the Committee.

BUILDING MATERIAL.

PARTITIONS.

Made of Perfected Brand Sackett Plaster Board and gypsinite studding.

Sackett boards composed of three layers of pure gypsum (plaster of paris) and four thin layers of wool felt, formed into slabs or sheets 3-8 inch in thickness and 32 x 36 inches in size. Each board stenciled "Sackett Patented May 22, 1894."

Gypsinite studding composed of pure gypsum fibered with wood and reinforced with two 1-2 x 2 inch wood nailing strips. Studs 3 inches square and furnished in lengths up to and including 12 feet.

Partitions composed of these studs spaced 16 inches, with cross pieces at top, bottom and middle, fastened together with No. 26 gage galvanized steel clips; covered with Sackett plaster boards attached to the studs by No. 10, 1-2 x 1-2 inch flat head, 3-4 barbed wire nails, 1 3-4 inches long, spaced not exceeding 6 inches; coated on each side with fibered gypsum plaster laid to 3-4 inch grounds.

Tests and investigations at Underwriters' Laboratories show that for heights not exceeding 12 feet, non-bearing partitions constructed as described possess somewhat higher fire retardant properties than partitions composed of wooden studding and wooden lath and fibered gypsum plaster or lime plaster; but these properties are not sufficiently higher to entitle this partition to a classification for corridor and room partitions in fireproof buildings, or for the enclosure of important vertical openings through buildings.

The following company manufactures this material:

New York, Sackett Plaster Board Co., 1123 Broadway.

BLOCKS FOR PARTITIONS.

Hollow Pyrobar Partition Blocks made of pure gypsum (plaster of paris) and wood fibre. Provided with 3 x 4 round, tapering core holes. Three to 5 inches in thickness, 12 inches wide and 30 inches long. Shells 7-16 to 1 3-8 inches and webs 13-16 to 1 inch in thickness.

When set on incombustible foundation, laid with broken joints in properly retarded gypsum plaster, and coated on each side with wood fibered gypsum plaster at least 1-2 inch in thickness, these blocks are **approved** for use in non-bearing corridor and room partitions not exceeding 13, 17 and 22 feet in height for the 3, 4 and 5 inch blocks respectively, in fireproof office buildings and buildings of this class, but **not** for bearing walls or partitions, nor for enclosures to stairways and elevators or important vertical openings through buildings.

The following company manufactures this material:

Chicago, United States Gypsum Company, 200 Monroe Street.

SLOTTED STEEL STUDDING FOR PARTITIONS.

Studding for 3, 4 and 5 inch hollow partitions. Studding made of No. 18 U. S. gage open hearth steel, in the form of channels 1 7-8, 2 3-8 and 3 3-8 inches in width. Spaced 11 3-4 inches apart, and attached to each other by strips punched from the center of the studs, thus forming horizontal braces at 17 inch intervals. Each stud provided with a shoe at bottom and extension piece at upper end for attaching direct to floors and ceilings, or to No. 16 gage steel channels, separately fastened to floors and ceilings at 48 inch intervals.

When securely anchored to incombustible floors and ceilings, provided with extension pieces lapping at least 3 inches, lathed on both sides with 3-4 by 1-2 inch diamond mesh expanded metal, at least No. 26 U. S. gage in thickness, tied to studs and at laps with No. 18 gage galvanized tie wire spaced 6 inches; and coated on both sides with fibered gypsum plaster laid to at least 3-4 inch grounds, the 1 7-8, 2 3-8 and 3 3-8 inch galvanized and painted studs are **approved** for use in non-bearing, corridor and room partitions not exceeding 15, 20 and 25 feet in height respectively, in fireproof office buildings and buildings of this class, but **not** for bearing walls or partitions, nor for enclosures to stairways and elevators or important vertical openings through buildings.

The following company manufactures this material:

Sharon, Pa., Sharon Steel Hoop Company.

POST CAP AND GIRDER SUPPORT (STEEL AND MALLEABLE IRON).

Caps inspected at factory bear structural material labels attached to an exposed side reading as follows:

The following companies are equipped to supply these devices:

Chicago, A. M. Castle & Co., 217–221 N. Jefferson Street.
Cleveland, The Duplex Hanger Co., Cleveland.

LUMBER.

Asbestos Building Lumber.

Asbestos Lumber manufactured by the following companies is considered from the insurance viewpoint as superior to wood for the uses intended.

Ambler, Pa., Keasbey & Mattison.
La Chine, Can., Asbestos Mfg. Co., Ltd.

Sagax Wood.

Made of ground straw, a cement binder and a few other ingredients, the exact composition being regarded as a trade secret.

Laboratory tests indicate that this material is non-combustible, a good non-conductor of heat, and when made in large sections of sufficient thickness is only slightly injured by

high temperatures and the subsequent application of water. It absorbs moisture slowly, is considerably heavier and more brittle than wood and can be worked with ordinary wood-working tools.

The following company manufactures this material:

Baltimore, Md., Sagax Wood Co.

Colonial Wall Board.

A product of calcined gypsum fibered with wood and containing small percentages of Portland cement and hydrated lime, formed into 32 x 36 inch sheets, or slabs, approximately 3-8 inch thick. Each board stenciled "Wall Board, made by the Colonial Wall Board and Plaster Co., Pittsburg, Pa."

Boards attached by No. 10, 1-2 x 1-2 inch flat head half barbed wire nails, 1 1-2 inch long, spaced not exceeding 6 inches apart at each support.

Tests and investigations at Underwriters' Laboratories show that this board is suitable as a base for fibered gypsum plasters and when attached as described to walls and ceilings, and coated with 1-2 inch of plaster, its fire retardant properties are considerably higher than those of wood lath with fibered gypsum plaster, or wood lath with gypsum plaster containing sand, or wood lath with lime and cement plaster in buildings in which wooden joists, studding and furring are used; but these properties are not sufficiently high to warrant the use of combustible backing where fireproof construction is desired.

The following company manufactures this material:

Pittsburg, Pa., Colonial Wall Board and Plaster Co., Frick Bldg.

Sackett Plaster Board.

"Perfected Brand." Composed of three layers of pure gypsum (plaster of paris) and four thin layers of wool felt, formed into slabs or sheets 3-8 inch in thickness and 32 x 36 inches in size. Each board stenciled "Sackett Patented May 22, 1894." Boards attached by No. 10, 1-2 x 1-2 inch flat head, 3-4 barbed wire nails, 1 1-4 inches long, spaced not exceeding 6 inches at each support.

Tests and investigations at Underwriters' Laboratories show that this board is a suitable base for fibered gypsum plasters, and when attached as described to walls and ceilings, and plastered, its fire retardant properties are somewhat higher than those of wooden lath and fibered gypsum plaster, or wooden lath and lime plaster, in buildings in which wooden studding, joist and furring are used; but these properties are not sufficiently higher to entitle the board to a materially better classification as a fire retardant.

The following company manufactures this material:

New York, Sackett Plaster Board Co., 1123 Broadway.

WALL HANGER (STEEL).

Hangers inspected at factory bear above structural material labels attached to an exposed side.

The following company is equipped to supply this device:

Cleveland, Ohio, The Duplex Hanger Co.

CANS, Waste.

Waste cans shown by examination conducted by Underwriters' Laboratories, Inc., to be in accordance with the requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., have labels attached reading:

The following companies are equipped to supply these devices:

Chicago, Justrite Mfg. Co,, N. W. Cor. Clinton and Van Buren Streets.
Cincinnati, The Witt Cornice Co., 2118–2124 Winchell Avenue.
St. Louis, Handlan-Buck Mfg. Co., 210 N. Third Street.
St. Louis, Missouri Lamp and Mfg. Co., 114–116 Elm Street.

The following waste can was listed before the inauguration of the label service covering this character of device and may be recognized by the trade name given:

Chicago, F. Cortez Wilson & Co., 239 Lake Street, "Nacefas."

DOORS AND SHUTTERS.

STANDARD TIN-CLAD FIRE DOORS AND SHUTTERS.

Standard Tin-Clad Fire Doors, shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by stamping in the tin plates or by attaching brass labels, reading:

Standard Tin-Clad Fire Shutters, shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by stamping in the tin plates or by attaching brass labels, reading:

Standard 2-ply Tin-Clad Fire Doors for stairs or elevators shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by attaching brass labels reading:

The label is evidence of proper construction of the appliance at the factory. Prospective users should first ascertain from the Underwriters having jurisdiction which type, if any, of fire door will be accepted in the location desired and should make contracts subject to approval by them of the sill, frame, hardware, installation and automatic attachments.

The following companies are equipped to supply these devices:

Akron, O., The Kasch Roofing Co., 16-24 Canal Street.
Atlanta, Ga., Dowman-Dozier Mfg. Co., 605 Rhodes Bldg.
Aurora, Ill., National Fire Door Co.
Beaumont, Texas, J. T. Booth.
Boston, J. B. Hunter & Co., 60 Summer Street.
Boston, George T. McLauthlin Co., 120 Fulton Street.
Brooklyn, Hiram A. Akerly, 173 Berry Street.
Buffalo, Chas. Bauers' Sons, 159 William Street.
Buffalo, Philip Christmann & Sons, Corner Virginia and Orange Streets.
Buffalo, Dusing & Hunt, 76 Main Street.
Buffalo, Machwirth Bros. Co., 201–209 Oak Street.
Buffalo, G. H. Peters & Co., 289–293 Oak Street.
Buffalo, F. J. Tingler & Son, 121 W. Eagle Street.
Chicago, Knisely Bros., Fifth Avenue and 28th Place.
Chicago, Lyon Fire Door Co., 1741-3 Walnut Street.
Chicago, J. C. McFarland & Co., 27th Street and Fifth Avenue.
Chicago, Variety Mfg. Co., Carroll and Sacramento Avenues.
Cincinnati, The M. Marcus Building Co., 1513–21 Plum Street.
Cincinnati, J. H. Shields, 231 Sycamore Street.
Cincinnati, Witt and Brown, 215 W. Third Street.
Cleveland, W. J. Birmingham, Huron Road and East 2d Street.
Cleveland, Cleveland Metal Roofing & Ceiling Co., 3103–3105 Detroit Avenue.
Cleveland, Cleveland Sheet Metal Works, 6933–5 Superior Avenue.
Cleveland, Kasch Roofing Co., 1119 Superior Avenue.
Cleveland, Mannen & Esterly Co., 2241–2255 St. Clair Avenue, N. E.
Cleveland, The O'Donnell Safety System Co., 3062 Superior Avenue, N. E.
Cleveland, The Ohio Roofing Co., 1819-31 East 37th Street.
Cleveland, Riester & Thesmacher Co., 325–329 Pearl Street.
Cleveland, Rudolph & Sons Co., 1416–1420 Prospect Avenue, N. W.
Columbus, Kinnear & Gager Mfg. Co., 326 Mt. Vernon Avenue.
Columbus, National Fire Equipment Co., 192 E. Long Street.
Columbus, F. O. Schoedinger, 146-148 N. 3d Street.
Denver, G. W. Brown, 1135 14th Street.
East St. Louis, Ill., East St. Louis Cornice Works.
Galveston, Texas, Texas Sheet Metal Works, 2624–2626 Mechanic Street.
Hoboken, N. J., The Leonard Sheet Metal Works, 215–221 Grand Street.
Holyoke, Mass., Coburn Trolley Track Manufacturing Co.
Kansas City, Geo. W. Johnson Mfg. Co., 209–11 W. 17th Street.
Louisville, Ky., E. G. Heartick, 915 East Broadway.

Louisville, Ky., J. F. Wagner & Sons, 1145–1149 Seventh Street.
Milwaukee, Biersach & Niedermeyer Co., 220 Fifth Street.
Milwaukee, Consolidated Sheet Metal Works, 661–673 Hubbard Street.
Milwaukee, R. Jeske & Bro., 111-119 Reservoir Ave.
Milwaukee, E. B. Tonnsen, 51-53 Third Street.
Minneapolis, Crittenden Roofing and Mfg. Co., 1121–3 Seventh Street, South.
Minneapolis, N. W. Roofing, Cornice and Stamping Works, 1113 S. Fifth Street.
Minneapolis, Selden Roofing and Manufacturing Co.
Minneapolis, Stremel Bros. Roofing & Cornice Co., 1215–1219 Washington Avenue, North.
Minneapolis, Variety Fire Door Co., 123 Western Avenue.
Newburyport, Mass., Victor Manufacturing Co.
New Orleans, American Sheet Metal Works, Carrollton Avenue and Edinburgh Street.
New Orleans, Estate of R. G. Holzer, 317–323 Burgundy Street.
New Orleans, A. J. Nelson Manufacturing Co., Ltd.
New Orleans, New Orleans Roofing and Metal Works, Scott, Toulouse, St. Louis Sts., and Carrollton Avenue.
New York, J. F. Blanchard Co., 23d Street and Broadway.
New York, Howell & Lawrence, 1788 First Avenue.
New York, Knoburn Co., 27 East 22d Street.
New York, John W. Rapp, 1 Madison Avenue.
New York, M. F. Westergren, Inc., 213–221 E. 144th Street.
Oklahoma City, Arthur R. Moore Sheet Metal Co., 113 California Avenue.
Omaha, Omaha Safe & Iron Works, 10th and Dodge Streets
Paterson, N. J., Hugh C. Lendrim Co.
Philadelphia, David Lupton's Sons Co., Allegheny Avenue and Tulip Street.
Philadelphia, The J. S. Thorn Co., 20th and Allegheny Avenue.
Pittsburg, Perritt Iron & Roofing Co., 6 Brushton Avenue.
Richmond, Ind., Richmond Safety Gate Co.
San Antonio, Tex., T. P. Walsh, 739 E. Houston Street.
San Francisco, Forderer Cornice Works, 16th Street and Potrero Avenue.
San Francisco, Rulofson Metal Window Works, 315–319 Monadnock Building.
San Francisco, San Francisco Cornice Co.
South Bend, Ind., Indiana Lumber and Mfg. Co.
St. Louis, Albert & Fischer Hardware & Sheet Metal Co., 2529 South Broadway.
St. Louis, Caplan Galvanized Iron Cornice Co., 4412-4414 Easton Avenue.
St. Louis, J. Eberle & Son, 2014–2016 Laclede Avenue.
St. Louis, Gerock Bros. Mfg. Co., 1352 Old Manchester Road.
St. Louis, O. K. Harry Steel Works, 2333–5 Papin Street.
St. Louis, Frank B. Higgins, 924 North Sixth Street.
St. Louis, Hopmann Cornice Co., 2500–2 North Jefferson Avenue.
St. Louis, A. L. Krauss Sheet Metal Works, 4260 Easton Avenue.
St. Louis, Mesker & Bro., 421-519 S. Sixth Street.
St. Louis, Missouri Fire Door Co., 100 South Commercial Street.
St. Louis, E. Murphy & Co., 3727–3731 Easton Avenue.
St. Louis, Powers & Boyd Cornice and Roofing Co., 3614–16 Laclede Avenue.
St. Louis, Richmond Safety Gate Co., 1117 Chemical Building.
St. Louis, Ruth Cornice Co., 4299 Easton Avenue.
St. Louis, St. Louis Fire Door Co., Cass and Collins Streets.
St. Louis, E. E. Souther Iron Co., 2206 North Second Street.
St. Louis, Standard Fire Door and Contracting Co., 3025 Texas Avenue.
St. Louis, Van der Au & Cluss Mfg. Co., 2408 So. Jefferson Avenue.
St. Louis, Wand & Niehaus, 3008 Kossuth Avenue.
St. Louis, West End Cornice Works, 4740 Delmar Avenue.
St. Paul, Perkins Mfg. Co., Corner Fairview and University Avenues.
Terre Haute, Ind., O'Herron–Hartman Co.
Toledo, O., The L. F. Burdick Co., 2011 Adams Street.
Toledo, O., J. L. Creswell, 120 N. St. Clair Street.
Toledo, O., G. Hofer & Co.
Toledo, O., Warnke Bros. Co.
Toronto, Ont., Can., Douglas Brothers, 124 Adelaide Street, West.
Toronto, Ont., Can., A. B. Ormsby, Ltd., 161–165 Queen Street, East.
West New York, N. J., A. J. Ellis.
Winfield, L. I., N. Y., Manhattan Fireproof Door Co., Maurice and Lexington Avenues.

METAL FIRE DOORS AND SHUTTERS.

Three-inch fire door, made of No. 24 U. S. gage crimped galvanized steel, in horizontal sections 8 inches wide, filled with mineral fibre.

Doors of this type shown by tests and examinations conducted by Underwriters' Laboratories to be the equivalent of the standard 2 1-2-inch fire door for openings **not exceeding 80 square feet in area** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by stamping in the plates or attaching brass labels, as shown above.

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Philadelphia, David Lupton's Sons Co., Allegheny Avenue and Tulip Street.

METAL FIRE DOORS.

Two and one-half-inch fire door, made of No. 26-inch gage steel, galvanized, in horizontal sections 8 inches wide, filled with mineral fibre. Sections tongued and grooved at intersections and held together by 1-2 inch vertical rods spaced 18 inches, passing through 2 1-2 by 1 1-2 by 3-16 inch angle at top and 1-4 by 2 1-2 inch bar at bottom of door.

Doors of this type shown by tests and examinations at Underwriters' Laboratories, to be the equivalent of the standard 2 1-2-inch tin-clad door for the protection of openings in fire walls **not exceeding 80 square feet in area**, and examined at factory and passed by Underwriters' Laboratories, Inc., are labeled by stampings in the plates or by attaching brass labels, as shown above.

The following company is equipped to supply these doors. Underwriters having jurisdiction should be consulted in all cases before installations are made.

Columbus, Ohio, Kinnear Manufacturing Co.

Door made of two thicknesses No. 22 U. S. gage corrugated galvanized sheet steel, with 1-16-inch sheet asbestos between. Corrugated steel sheets on opposite sides of door are bolted and riveted together only at edges. Doors stiffened by flat bars and galvanized iron channels at edges.

Doors of this type shown by tests and examinations conducted by the Underwriters' Laboratories to be the equivalent of the standard 2 1-2-inch fire door for openings **not exceeding six feet in width** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by attaching brass label shown above.

The following company is equipped to supply these doors. Underwriters having jurisdiction should be consulted in all cases before installations are made.

Memphis, Tenn., Saino Fire Door & Shutter Co., Tennessee Trust Building.

COMPOSITION FIRE DOORS.

Two-inch solid door made of Sagax wood reinforced by 1-8-inch round steel rods in both directions, located in middle of door. Rods interlaced and extend close to edges of door. Vertical rods spaced not exceeding 4 inches and twisted around 1-4-inch horizontal rod at top. Horizontal rods spaced not exceeding 6 inches.

Doors of this type shown by tests and examinations conducted by the Underwriters' Laboratories to be the equivalent of the standard tin-clad door for openings **not exceeding 80 square feet in area** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by attaching brass label shown above.

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Baltimore, Md., The Sagax Wood Co., 106 Dover Street.

COMPOSITION FIRE SHUTTERS.

One and one-half inch solid shutter made of Sagax wood, reinforced by 1-8-inch round steel rods in both directions and a layer of expanded metal having 1 by 1-2 inch mesh. Vertical rods spaced not exceeding 9 inches and horizontal rods 11 inches apart. Reinforcing members located approximately midway between the surfaces of the door and extend to within one inch of all edges. Shutters provided with 3 hinges where in excess of 3 feet in width or 8 feet in height, and with ogee rabbet where they are made in pairs.

Shutters of this type shown by tests and examinations conducted by Underwriters' Laboratories, Inc., to be the equivalent of standard tin-clad fire shutters for the protection of exterior openings, and examined at factory and passed by Underwriters' Laboratories, Inc., are labeled by attaching brass labels as shown above.

The following company is equipped to supply this device. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Baltimore, Md., The Sagax Wood Co., 106 Dover Street.

DOUBLE STEEL ROLLING FIRE DOORS.

For openings not exceeding 8 feet wide and 9 feet high where standard fire doors cannot be employed. Automatic double steel rolling doors, **mounted in reveal on each side of wall,** overlapping at sides. Spring counter-balanced. Curtains made of No. 16 U. S. gage galvanized open hearth steel slats, interlocked at edges.

Doors examined at factory and passed by Underwriters' Laboratories, Inc., have labels attached to the bottom bar reading:

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Columbus, O., Kinnear Mfg. Co. Marking, "Abacus No. 3."

STEEL ROLLING FIRE SHUTTERS.

Normally open automatic steel rolling shutter for exterior openings not exceeding 10 feet wide and 10 feet high.

Shutters examined at factory and passed by Underwriters' Laboratories, Inc., have labels attached to the bottom bar reading as shown above.

The following company is equipped to supply these devices:

Columbus, O., Kinnear Mfg. Co. Marking, "Abacus No. 4."

CORRIDOR OR PARTITION DOORS.

Doors shown by tests and examinations conducted by Underwriters' Laboratories, Inc., to possess sufficient fire retardant value to warrant approval in corridors and partitions but **not for openings in fire walls** (see list of Fire Doors and Shutters) and examined at

factories and passed by Underwriters' Laboratories, Inc., bear etched brass labels attached to the back edge reading:

This label is evidence of proper construction of the door at the factory. Prospective users should first ascertain from the Underwriters having jurisdiction which type, if any, of these doors will be accepted in the location desired, and should make contracts subject to the approval by them of sizes, mounting, hardware and frame.

The following companies are equipped to supply these devices in the types indicated:

METALLIC DOORS.

Bradford, Pa., American Metal Door Co. 1⅜-inch door, frame, trim.
Chicago, Knisely Bros., 5th Avenue and 28th Place. 2-inch door, frame, trim.
Chicago, Voigtmann & Co., 445 West Erie Street. 2-inch door, frame, trim.
Jamestown, N. Y., Art Metal Construction Co. 1⅜-inch door, frame, trim.
Jamestown, N. Y., Dahlstrom Metallic Door Co. 1½-inch door, frame, trim.
Minneapolis, Northwestern Roofing, Cornice & Stamping Works, 1113 S. Fifth Street. 2-inch door, frame, trim.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 1 13-16-inch door. Door only.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 1¾-inch door, frame, trim.
New York, John W. Rapp, 1 Madison Avenue. 1¾-inch door, frame, trim.
Youngstown, O., General Fireproofing Co. 2-inch door, frame, trim.

METAL-CLAD DOORS.

Chicago, Knisely Bros., 5th Avenue and 28th Place. 2-inch door only.
Hoboken, N. J., Leonard Sheet Metal Works, 219, 221 Grand Street. 1¾-inch door.
Minneapolis, Thorp Fireproof Door Co., 1600–1616 Central Avenue. 1⅞-inch door, frame, trim.
Minneapolis, Thorp Fireproof Door Co., 1600-1616 Central Avenue. 2⅛-inch door, frame, trim.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 1⅞-inch door only.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 2⅛-inch door only.
New York, Howell & Lawrence, 1788 First Avenue. 1¾-inch door only.
New York, John W. Rapp, 1 Madison Avenue. 2-inch door, frame, trim.
Winfield, L. I., N. Y., Manhattan Fireproof Door Co , Maurice and Lexington Avenues. 1¾-inch door only. Known as "Standard A."
Winfield, L. I., N. Y., Manhattan Fireproof Door Co., Maurice and Lexington Avenues. 1¾-inch door only. Known as "Standard B."

COMPOSITION DOORS.

Baltimore, Md., Sagax Wood Co., 106 Dover Street. 1¾-inch door and frame. Known as "Perfection."

STAIR OR ELEVATOR DOORS.

Doors shown by tests and examinations conducted by Underwriters' Laboratories, Inc., to possess sufficient fire retardant value to warrant approval in **stair and elevator** enclosures **but not for openings in fire walls,** and examined at factories and passed by Underwriters' Laboratories, Inc., bear etched labels attached to the back edge reading:

The label is evidence of proper construction of the door at the factory. Prospective users should first ascertain from the Underwriters having jurisdiction which type, if any, of these doors will be accepted in the location desired and should make contracts subject to the approval by them of frame, sill, size, installation and automatic attachments.

The following companies are equipped to supply doors bearing these labels, the approval being restricted by the limitations specified in italics over each group.

METALLIC DOORS, not filled with wood.

Single swinging doors for openings not exceeding 48 inches in width and single swinging doors in pairs for openings not exceeding 72 inches in width, which when equipped with special hardware and mounted in special frames have been shown to be the equivalent of doors mounted in standard frames with standard hardware for this class of service.

Chicago, Knisely Bros., Fifth Avenue and 28th Place, 2-inch door and hardware.

METALLIC DOORS, not filled with wood.

Single swinging doors for openings not exceeding 48 inches in width and doors in pairs for openings not exceeding 72 inches in width, equipped with special hardware which when used in connection with these doors mounted in standard frames has been shown to be the equivalent of standard hardware.

Chicago, Knisely Bros., Fifth Avenue and 28th Place, 2-inch door and hardware.
Chicago, Voigtmann & Co., 445 W. Erie Street, 2-inch door and hardware.

METALLIC DOORS, not filled with wood.

Single swinging doors for openings not exceeding 48 inches in width and doors in pairs for openings not exceeding 72 inches in width when mounted in standard frames with standard hardware.

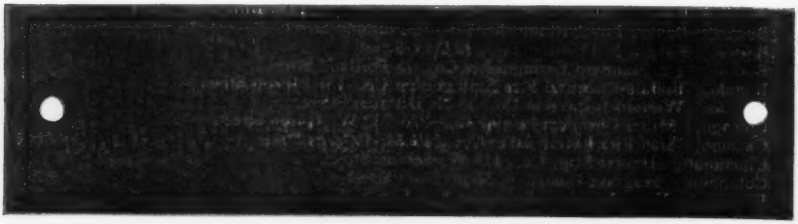
Bradford, Pa., American Metal Door Co. 1¾-inch door.
Chicago, Knisely Bros., 5th Avenue and 28th Place. 2-inch door.
Chicago, Voigtmann & Co., 445 W. Erie Street. 2-inch door.
Jamestown, N. Y., Art Metal Construction Co. 1¾-inch door.
Jamestown, N. Y., Dahlstrom Metallic Door Co. 1 9-16-inch door.
Minneapolis, Minn., Northwestern Roofing, Cornice & Stamping Works, 1135 Fifth Street. 2-inch door.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 1 3-16 inch door.
New York, John W. Rapp, No. 1 Madison Avenue. 1¾-inch door.
Youngstown, O., General Fireproofing Co. 2-inch door.

METAL-CLAD WOOD DOORS.

Chicago, Knisely Bros., Fifth Avenue and 28th Place. 2-inch door.
Minneapolis, Thorp Fire Proof Door Co., 1600–1616 Central Avenue. 2¼-inch door.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 2¼-inch door.
New York, Howell & Lawrence, 1788 First Avenue. 1¾-inch door.
New York, John W. Rapp, 1 Madison Avenue. 2-inch door.
Winfield, L. I., N. Y., Manhattan Fireproof Door Co., Maurice and Lexington Avenues. 1¾-inch. Known as "Standard A."

STEEL ROLLING DOORS.

Automatic steel rolling elevator doors examined at factories and passed by Underwriters' Laboratories, Inc., may be distinguished by brass labels attached to bottom bar reading as follows:



The following companies are equipped to supply doors bearing these labels, the approval being restricted by the limitations specified in italics over each group.

Automatic steel rolling elevator doors for openings not exceeding 8 feet in width and 9 feet in height, in shafts which do not communicate with more than one fire section. Doors mounted on face of wall.

Chicago, Variety Mfg. Co., Carroll and Sacramento Avenues. Door known as "Variety No. 33."
Columbus, Kinnear Mfg. Co., Columbus. Door known as "Abacus No. 1."
New York, J. G. Wilson Mfg. Co., factory at Norfolk, Va. Door known as "Wilson Arrangement No. 1."

Automatic steel rolling elevator doors for openings not exceeding 8 feet in width and 9 feet in height, in standard shafts which communicate with more than one fire section, and in non-standard shafts which communicate with more than one fire section when the opening in wall is additionally protected by a standard fire door.

Columbus, Kinnear Mfg. Co., Columbus. Door known as "Abacus No. 2."

EXTINGUISHERS, HAND CHEMICAL, 3 Gallon.

Carbonic Acid Gas Hand Fire Extinguishers shown by tests and examinations conducted by Underwriters' Laboratories, Inc., to be in accordance with the rules of the National Board of Fire Underwriters and examined and tested at factories and passed by Underwriters' Laboratories, Inc., have metal label soldered to the front of the cylinder, reading:

The label is evidence of proper construction of the appliance at the factory. Prospective users should first ascertain from the Underwriters having jurisdiction under what conditions extinguishers of this type will be accepted and should make contracts subject to approval by them of setting, distribution and number to be used in respect to floor area.

The following companies are equipped to supply these devices:

Ansonia, Conn., Metropolitan Fire Extinguisher Co., 1133 Broadway, N. Y.
Boston, Badger Fire Extinguisher Co., 32 Portland Street.
Boston, Knight & Thomas, Inc., 99 State Street.
Boston, The Standard Extinguisher Co., 78 Portland Street.
Buffalo, Buffalo Chemical Fire Extinguisher Co., 154 Ellicott Street.
Buffalo, Western Inspection Co., 45 N. Division Street.
Chicago, Miller Chemical Engine Co., 220–222 W. Huron Street.
Chicago, Staff Fire Extinguisher Co., 543-545 Orleans Street.
Cincinnati, Harker Mfg. Co., 118 W. Second Street.
Columbus, Seagrave Company, South High Street.
Elmira, N. Y., American-LaFrance Fire Engine Co.
Minneapolis, Minn., Northern Fire Apparatus Co., 1301–1307 Third Street, South.
Montreal, Can., The Garth Co., 26–32 Craig Street, West.
Newark, N. J., The Tea Tray Company of Newark, N. J., Mulberry and Murray Streets.
Petrolia, Ont., Canada, Stempel Mfg. Co., Ltd.
Philadelphia, James Boyd & Bro., 25th and Wharton Streets.
Pittsburg, Fire Extinguisher & Supply Co., 1414–1422 Spring Garden Avenue, N. S.
Pittsburg, Pittsburg Lamp, Brass & Glass Co., Foot of Locust Street.
Portland, Me., Conqueror Fire Extinguisher Co., 120 Exchange Street.
Racine, Wis., Racine Iron & Wire Works, 1022 Douglas Avenue.
St. Louis, Frank & St. Gemme Mfg. Co., 815–817 Market Street.
St. Louis, Missouri Lamp and Mfg. Co., 116 Elm Street.
St. Louis, Stempel Fire Extinguisher Mfg. Co., 4250 North 20th Street.
Toronto, Canada, Victor Fire Extinguisher Company, 704 Continental Life Building.
Utica, O. J. Childs Co., 50 Liberty Street.

EXTINGUISHERS ON WHEELS, CHEMICAL, 40 Gallons.

Carbonic Acid Gas Fire Extinguishers of 40 gallons capacity mounted on wheels, shown by tests and examinations conducted by the Underwriters' Laboratories, Inc., to be in accordance with the requirements of the National Board of Fire Underwriters and examined and tested at factories and passed by Underwriters' Laboratories, Inc., have metal label soldered to the front of the cylinder reading:

The following companies are equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installations are made.

Boston, Badger Fire Extinguisher Co., 32 Portland Street.
Elmira, N. Y., American-LaFrance Fire Engine Co.

EXTINGUISHERS, Miscellaneous.

WAGGONER SANATORY FIRE BUCKET.

This pail as submitted complies with the rules of the National Board of Fire Underwriters in details of construction and is designed in a manner which effectually protects its contents from evaporation and foreign matter.

Where it is designed to protect the contents of exposed pails against freezing by the addition of calcium chloride or other salts Underwriters having jurisdiction should be consulted.

The following company manufactures this bucket:

Chicago, Ill., Waggoner Sanatory Fire Bucket Co., 1340 West Lake Street.

FUSIBLE LINK.

Links examined at factory and passed by Underwriters' Laboratories, Inc., may be distinguished by label attached to each box of 100 links, sealing the box, reading as follows:

The following manufacturer is equipped to supply this device for use in connection with automatic closing devices for doors and windows, and automatic devices requiring fusible links where the loads to which the links are subjected do not exceed the following:

5 lbs. where a factor of safety of 5 is required.
6 1–4 lbs. where a factor of safety of 4 is required.
8 1–3 lbs. where a factor of safety of 3 is required.

Chicago, Voigtmann & Co., 445–459 W. Erie Street.

GLASS. (See Wired Glass.)

HARDWARE, For Doors and Shutters.

Standard $3\frac{1}{2}$x$\frac{8}{8}$-inch hardware for *sliding fire doors* only, shown by tests and examinations conducted by the Underwriters' Laboratories, Inc., to be in accordance with requirements of the National Board of Fire Underwriters and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll reading as follows:

A tag is also attached to one hanger of each set on which is printed a list of the pieces which a complete set should contain, as follows:

1. One $3\frac{1}{4}$x$\frac{3}{4}$-inch track, length to be equal to twice the width of the door opening, plus 21 inches. Punched for wall bolts. 2. Two hangers for openings six feet and less in width; three hangers for openings wider than six feet. Bolts for attaching hangers to door. 3. Two $3\frac{1}{4}$x$\frac{3}{4}$-inch binders. 4. One $2\frac{1}{4}$x$\frac{1}{4}$-inch stay roll. Stay roll should be the type specified for the form of sill used and should include

all bolts except wall bolts. 5. One cast-iron bracket for each track bolt. 6. Two ¾x⅛-inch half oval chafing strips for back of door, two 1x⅛-inch flat strips for front of door opposite the oval strips. Bolts for fastening above strips together through door. Length of above strips to be 4 inches less than door opening. 7. One 1⅛x⅛-inch strip 5 inches less than width of door to take wear of stay roll. Wood screws for attaching. 8. One wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts and screws for attaching. 10. One front bumper and one back bumper. 11. Four bumper shoes and screws for attaching. Note: Each bumper shoe made in two pieces 12. One washer for each wall bolt, including those for binders and stay roll. 13. One instruction card for mounting.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The label is evidence of proper construction of the appliance at the factory. Prospective users should first ascertain from the Underwriters having jurisdiction which type of hardware will be accepted in the location desired and should make contracts subject to approval by them of the fire door equipment complete, including sill, mounting and automatic attachments.

The following companies are equipped to supply this hardware:

Aurora, Ill., Richards Mfg. Co. Marking, "Monarch A."
Aurora, Ill., Wilcox Mfg. Co. Marking, "Wilcox 501 A."
Boston, Geo. T. McLauthlin Co., 120 Fulton Street. Marking, "McLauthlin A."
Cleveland, O'Donnell Safety System Co., Corner Superior Avenue and 31st Street, N. E. Marking, "O'Donnell A."
Chicago, Variety Mfg. Co., Carroll and Sacramento Avenues. Marking, "Variety A."
Holyoke, Mass., Coburn Trolley Track Mfg. Co. Marking, "Coburn A."
Newburyport, Mass., Victor Mfg. Co. Marking, "Victor A."
New York, The McCabe Hanger Mfg. Co., 425–427 W. 25th Street. Marking, "'A' McCabe."
Philadelphia, Jas. Peters & Son, 1934–38 N. Front Street. Marking, "Peters A."
Richmond, Richmond Safety Gate Co. Marking, "A. Richmond."
San Francisco, Falls Mfg. Co., 317 First Street. Marking, "Falls A."
South Milwaukee, Wis., Stowell Manufacturing & Foundry Co. Marking, "No. 20–A Wilbern."
St. Louis, Mesker & Bro., 421–519 South Six Street. Marking, "Mesker & Bro. 'A'."

. . . . . .

Specially designed malleable iron hardware for *sliding fire doors*, which is considered to be the full equivalent of the 3½x⅜-inch steel hardware made in accordance with the requirements of the National Board of Fire Underwriters and examined at factories and passed by Underwriters' Laboratories, Inc., may be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll as shown above.

A special tag is attached to one hanger of each set on which is printed a list of the pieces which a complete set should contain, as follows:

1. One 1 7-16-inch tubular track, length to be equal to twice the width of door opening, plus 14 inches. 2. Two hangers for openings six feet and less in width, three hangers for openings wider than six feet, and bolts for attaching hangers to door. 3. Two malleable iron binders. 4. One malleable iron stay roll. 5. Brackets to carry track, including two special end supports. 6. Two ¾x⅛-inch half oval chafing strips for back of door, two flat strips for front of door opposite the oval strips. Bolts for fastening above strips together through the door. Length of above strips to be 4 inches less than door opening. 7. One 2¼x⅛-inch strip 5 inches less than width of door to take wear of stay roll, with wood screws for attaching. 8. One malleable iron wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts for attaching. 10. One front bumper and one back bumper. 11. Four bumper shoes and screws for attaching. Note: Each bumper shoe made in two pieces. 12. One washer for each wall bolt, including those for binders, bumpers and stay roll.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following companies are equipped to supply this hardware:

Chicago, Allith Manufacturing Co., Taylor Street and 43d Avenue. Marking, "Allith A-06."
Hamilton, Can., Allith Mfg. Co. Marking, "Allith H."

Specially designed malleable iron hangers, tubular steel track and malleable iron brackets for *sliding fire doors*, which are considered to be the full equivalent of 3½x⅝-inch steel hardware made in accordance with the requirements of the National Board of Fire Underwriters, approved in combination with the balance of the set of standard 3½x⅝-inch steel hardware and examined at factory and passed by Underwriters' Laboratories, Inc., can be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll as shown above.

A special tag is attached to one hanger of each set on which is printed a list of pieces which a complete set should contain, as follows:

1. One 1¾-inch tubular steel track, length to be equal to twice the width of the door opening plus 14 inches. 2. Two hangers for openings six feet and less in width; three hangers for openings wider than six feet. Bolts for attaching hangers to door. 3. Two 3½x¾-inch binders. 4. One 2½x⅝-inch stay roll. Stay roll should be the type specified for the form of sill used, and should be provided with all bolts except wall bolts. 5. Malleable iron brackets for carrying track, including two special end supports, which are also designed to act as front and back bumpers respectively. 6. Two ¾x¼-inch half oval chafing strips for back of door; two flat strips for front of door opposite chafing strips. Bolts for fastening strips together through door. Length of above strips to be 4 inches less than door opening. 7. One 1½x⅛-inch strip 5 inches less than width of door. Wood screws for attaching. 8. One wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts for attaching. 10. Four bumper shoes and screws for attaching. *Note:* Each bumper shoe made in two parts. 11. One washer for each wall bolt, including those for binders, bumpers and stay roll. 12. One instruction card for mounting.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following company is equipped to supply this hardware:

Aurora, Ill., Wilcox Manufacturing Co. Marking, "Wilcox No. 645."

. . . . . .

Hardware for *sliding metal fire doors* filled with mineral fibre, which is considered to be the full equivalent of the 3½x⅝ inch steel hardware made in accordance with the requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., may be distinguished by labels applied to each hanger, binder and stay roll of each set, as shown above.

A special tag is attached to one hanger of each set, on which is printed a list of the pieces which a complete set should contain, as follows:

1. One 3½x¾-inch track, length to be equal to twice the width of the door opening, plus 21 inches. Punched for wall bolts. 2. Two hangers for openings six feet and less in width; three hangers for openings wider than six feet. Bolts for attaching hangers to doors. 3. Two 3½x¾-inch binders. 4. One 2½x½-inch stay roll. 5. One cast-iron bracket for each track bolt. 6. Two ¾x¼-inch half oval chafing strips for back of door. Length of strips to be four inches less than door opening. 7. One 1½x⅛-inch strip to take wear of roller guide, provided with 9/16-inch counter-sunk holes spaced 5½ inches apart. 8. One cast-iron wedge with machine screws for attaching. 9. One bow-shaped handle, and one flush pull with 2¾-inch cap screws and two ¾-inch counter-sunk machine screws for attaching. 10. One front bumper and one back bumper. 11. Two binder shoes and machine screws for attaching. 12. One washer for each wall bolt, including those for binders and stay roll.

Where the hardware for a single fire door on each side of the wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length varies in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following company is equipped to supply this hardware:

Columbus, Ohio, Kinnear Manufacturing Co. Marking, "Kinnear A."

. . . . . .

Standard hardware for single 2 1-2 inch *swinging fire doors*. Mounted on face of wall.

Standard hardware for single 2 1-2 inch swinging fire doors shown by tests and examinations made by Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by labels applied to each wall strip for

hinges, each wall strip for catches, and connecting bar for latches, of each set reading as shown above.

A special tag is also attached to one hinge of each set, on which is printed a list of the pieces which a complete set should contain, as follows:—

1. Three 2 1-2 x 1-2 inch wall eyes attached to 2 1-2 x 1-4 inch wall strip. 2. Three 2 1-2 x 3-8 inch hinges, 1-2 inch carriage bolts for attaching. 3. Three 2 x 3-8 inch catches attached to 2 1-2 x 1-4 inch wall strip. 4. Three 1 1-2 x 3-8 inch latches attached to 1 1-2 x 1-4 inch connecting bar. Two door plates and two 5-16 inch machine bolts for each latch. 5. Two handles with 1-2 inch spindle and 1-4 inch triangular plate for operating. 6. Three keepers with six 3-8 inch machine bolts for attaching. 7. One latch spring with adjusting rod and 1 1-4 x 1 1-4 x 3-16 inch angle piece. No. 12 wood screw for attaching. 8. Six 4-inch cast iron washers for wall bolts. 9. One instruction card for mounting.

Where the hardware for a single fire door on each side of the wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length varies in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following company is equipped to supply this hardware:

Chicago, Variety Manufacturing Co., Carroll and Sacramento Avenues. Marking, "Variety A."

HANGERS ONLY.

Specially designed adjustable malleable iron hanger for *sliding fire doors*. Approved only in combination with a complete set of approved fixtures for sliding doors, and in locations where an adjustable hanger is acceptable to Underwriters having jurisdiction. Hangers examined at factory and passed by Underwriters' Laboratories, Inc., may be distinguished by approved name and issue mark and by labels shown above.

The following companies are equipped to supply this hardware:

Chicago, Allith Mfg. Co., W. Taylor and S. 43rd Ave. Marking "Allith No. 6."
South Milwaukee, Wis., Stowell Manufacturing & Foundry Co. Marking, "Wilbern No. 4A."

HARDWARE FOR WINDOWS.

SASH LOCKS.

Malleable iron locks examined at factory and passed by Underwriters' Laboratories, Inc., have attached to each box of **twelve locks,** sealing the box, label reading as follows:

The following manufacturers are equipped to supply these devices:

Chicago, Payson Manufacturing Co., 2918 Jackson Boulevard.
New Haven, Conn., The H. B. Ives Co., 11–17 Artizan Street.

Gravity Locks for Pivoted Windows examined at factory and passed by Underwriters' Laboratories, Inc., have attached to each box of **three locks,** sealing the box, label reading as above, except the figure 3 appears on the label instead of 12.

The following manufacturer is equipped to supply these devices:

Philadelphia, Pa., Jas. Peters & Son, 1934–1938 North Front Street.

Pivots and Gravity Locks for pivoted windows examined at factory and passed by Underwriters' Laboratories, Inc., may be distinguished by label attached to each box of three (3) sets, sealing the box, reading as follows:

The following companies are equipped to supply these devices:

Milwaukee, Consolidated Sheet Metal Works, 661–673 Hubbard Street.
Newark, N. J., Frank F. Smith, 19 Division Street.
New York, J. W. Yates, 156 9th Avenue.

. . . . . .

Sash tilting and locking mechanism for manually operated windows examined at factory and passed by Underwriters' Laboratories, Inc., may be distinguished by label attached to each package, in such a manner that the label will be destroyed in opening, reading as above.

Complete set consists of two balance arms and fittings, four sash guide pins, two switches, two groove plates, two latches and two catches. These parts are approved for use in connection with labeled windows especially designed for this type of hardware in locations where an automatic closing feature is not required by the Underwriters having jurisdiction.

The following company is equipped to supply these devices:

Philadelphia, Pa., Austral Window Balance Co., 1326 Chestnut Street.

SASH CHAINS.

The following sash chains in the sizes indicated have been examined and tested and are approved for use on metallic window frames and sash with wired glass as follows:

Bridgeport, Conn., Bridgeport Chain Co. Hot Galvanized Steel Sash Chain, looped type.

Size No. 1 for sash weighing not more than 80 pounds.
Size No. 2 for sash weighing not more than 130 pounds.
Size No. 3 for sash weighing not more than 195 pounds.

Oneida, N. Y., Oneida Community, Ltd. Community Guaranteed Sash Chain, galvanized steel, loop type.

Size No. 80 for sash weighing not more than 90 pounds.
Size No. 100 for sash weighing not more than 120 pounds.
Size No. 130 for sash weighing not more than 160 pounds.
Size No. 250 for sash weighing not more than 210 pounds.

HEAT INSULATING COVERINGS.

CORK BOARD (Nonpareil) LAID IN CEMENT MORTAR.

Two-ply construction, consisting of two layers of 2-inch Nonpareil corkboard bedded in ½-inch layers of cement mortar and covered with a ½-inch finish coating of the same material.

This material is approved for heat insulating purposes for walls, floors and ceiling, in cold storage warehouses, cold storage cellars in breweries, cold rooms in packing houses, hotel refrigerators, fur storage rooms and rooms of this character.

The following company manufactures this material:

Pittsburg, Pa., Armstrong Cork Co.

HOSE.

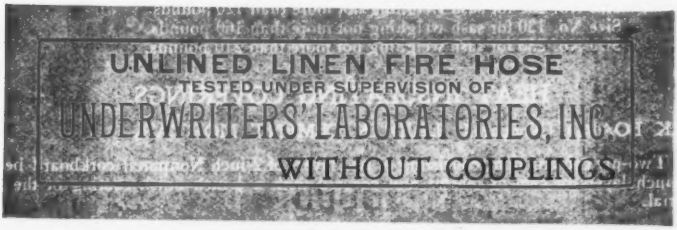
COTTON RUBBER-LINED.

Owing to the present attitude assumed by the manufacturers in this industry no general approvals are extended to these goods. The Underwriters' Laboratories label service is available for use in this industry and users may arrange for tests at the Laboratories under the National Standard specifications.

UNLINED LINEN.

Unlined Linen Fire Hose for use inside buildings shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by label attached to each length **with couplings attached** reading as follows:

Laboratory Labels, on hose shipped from factories **without** couplings attached, read:



The following companies are equipped to supply this material:

Lawrence, Mass., Wm. and Chas. Beck.
Malden, Mass., Chas. Niedner's Sons Co., 10 James Street.
New York, Eureka Fire Hose Mfg. Co., 13 Barclay Street.

FOR CHEMICAL FIRE EXTINGUISHER.

Fire extinguisher hose consisting of two tubes of woven cotton fabric separated by a layer of rubber composition, and having inner and outer layers of black and red rubber composition respectively.

As manufactured by the following company it is approved for use on *three gallon hand chemical extinguishers* when tested in the manner required by the Standard Specifications and found satisfactory in strength and construction.

Wilmington, Delaware, Electric Hose and Rubber Co. Marking: "Electric"

HYDRANTS.

Until such time as results of tests of fire hydrants under the revised specifications are secured, this device is believed to be as suitable for the puposes intended as others of its class.

Indian Orchard, Mass., Chapman Valve Mfg. Co.

PAINTS, FIRE RETARDANT.

These coatings for wood and other similarly combustible building materials which come under this class, or property so coated, should in no sense be considered as "fireproof." Their use is preferable to leaving the material uncoated, because they retard the spread of fire over combustible surfaces and are particularly desirable in lieu of varnish, shellac, or oil finish, which latter serve to rapidly spread fire. Attention is called, however, to the need of renewal of the coatings in order to maintain the desired conditions.

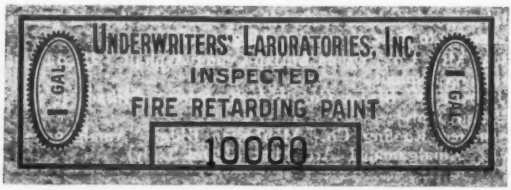
Whitewash so well meets the requirements of this class that we print formula recommended by the Lighthouse Board of the United States Treasury Department as follows:

"Slake one-half bushel of unslaked lime with boiling water, keeping it covered during the process; strain it and add a peck of salt dissolved in warm water; three pounds of ground rice, put in boiling water and boil to a thin paste; one-half pound powdered Spanish whiting and a pound of clear glue dissolved in hot water; mix these well together and let the mixture stand for several days. Keep the wash thus prepared in a kettle or portable furnace and when used put it on as hot as possible with painter's or whitewash brushes."

☞ Where possible the coatings should be applied by a hand brush rather than by a spraying machine, thus effecting a better surface, and special care should be exercised not to coat sprinkler heads where installed.

Boston, Wadsworth, Howland & Co., 82–84 Washington Street. Bay State Brick and Cement Coating.

This coating is put up in cans and barrels and sold as a ready-mixed paint. The product examined at the factory and passed by Underwriters' Laboratories, Inc., can be distinguished by label attached to each container reading as follows:



The so-called "cold water" paints listed below have been examined and tested.

Chicago, Geo. Fletcher & Co., 324 N. Ashland Avenue. "Monarch."
Chicago, Benj. Moore & Co., 401–409 N. Green Street. "Decorine."
Chicago, United States Gypsum Co. "U. S. G."
Cincinnati, O., The Philip Carey Mfg. Co. By Neptune Paint Co. "Carey's."
Grand Rapids, Mich., Alabastine Co. "Alabastine."
Hudson, Mich., The Neptune Paint Co. "Nepolite."
Milwaukee, Wis., H. W. Johns-Manville Co., By Neptune Paint Co. "J. M."
Milwaukee, Wis., Retardo Fire Proof Paint Co., By Benj. Moore & Co. "Retardo."
New Brighton, S. I., N. Y., The Muralo Co., "Asbestine." "Indeliblo." "Indurine."
New York, N. Y., M. Ewing Fox & Co., 136th Street and Rider Avenue. "Fox's Interior Permanite."

PLAY PIPE.

The National Standard Play Pipe for 2½-inch hose manufactured by the following company has been examined and tested and is approved for use:

New York, Eureka Fire Hose Manufacturing Co., 13 Barclay Street.

PUMP GOVERNOR.

The "Boardman" pump governor for control of National Standard Steam Fire Pumps manufactured by the following company has been examined and tested and approved for use.

Salem, Mass., Locke Regulator Co.

RECEPTACLES.

These receptacles commonly designated as "Safety Cans" are designed for the storage and handling of open stock of benzine, gasolene, naphtha, and other inflammable fluids. While not reducing the dangerous character of the fluid which they contain, they are considered as mitigating the extremely dangerous conditions attending the storage and handling of inflammable fluids in the common light sheet metal and glass receptacles generally used for this purpose.

Receptacles examined at factories and passed by Underwriters' Laboratories, Inc., have metal labels attached reading as follows:

The following companies are equipped to supply these devices:

Chicago, Geo. W. Diener Mfg. Co., 400-416 Monticello Avenue.
Milwaukee, Imperial Safety Can Co.

ROOFINGS.

Certain proprietary roofings listed below have been examined and tested.

These tests indicate that the fire retardant properties of these materials are inferior to those of slate, metal or good tin-clad roofs, but in a class with those of good slag and good gravel roofs, and superior to those of wooden shingle roofs.

Aurora, Ill., Usona Mfg. Co. Usona Burlap Center Asphalt. Usona Gravel Surfaced. Usona Pebble Top Asphalt.
Boston, Mass., J. A. & W. Bird & Co., 35 India Street. Mikado (2 and 3 ply). Rex Flintkote (2 and 3 ply).
Chicago, Amalgamated Roofing Co., Manhattan Bldg. Amalgamated Arc Rubber (2 and 3 ply). Amalgamated Arc Flint (2 and 3 ply).

Chicago, F. Becker Asphaltum Ready Roofing Co., 1510-12 Milwaukee Avenue. Becker Asphaltum Ready Roofing (2 and 3 ply).
Chicago, Elaborated Ready Roofing Co., 4419 La Salle Avenue. Elaborated Ready Roofing.
Chicago, Ford Manufacturing Co., 2335-2341 La Salle Street. Eclipse Rubber, Ford Prepared (3 ply). Galvanized Rubber.
Chicago, The Heppes Co., 4500 Filmore Avenue. Carbonite (2 and 3 ply). Flexo (2 and 3 ply). No-Tar (2 and 3 ply). Rubbertex (2 and 3 ply).
Chicago, The Lehon Mfg. Co., W. 43rd Street, Lincoln to Robey. Roofrite.
Chicago, The Patent Vulcanite Roofing Co., 1288 S. Campbell Avenue. Vulcanite (2 and 3 ply).
Chicago, Rubbertex Cloth & Paper Co., Commercial National Bank Bldg. Lonabond.
Chicago, Sall Mountain Asbestos Mfg. Co., 234 La Salle Street. Reliance Rubber (2 and 3 ply).
Chicago Heights, Ill., Paraffine Paint Company. Cronolite (2 ply).
Cincinnati, O., Philip Carey Mfg. Co. Carey's Standard Magnesia Flexible Cement.
Denver, Col., Western Elaterite Roofing Co., 841–4 Equitable Building. Elaterite.
East St. Louis, Ill., All Roofing Manufacturing Co. Armco (2 ply).
East St.Louis, Ill., The General Roofing Mfg. Co. Rubber (2 and 3 ply).
East Walpole, Mass., F. W. Bird & Son. Paroid (2 and 3 ply).
Edwardsville, Ill., National Roofing Materials Co. Mastic.
Erie, Pa., H. F. Watson Co. Indruroid (2 and 3 ply).
Houston, Texas, The Texas Company. Texaco Felt (2 and 3 ply).
Jersey City, N. J., Stowell Mfg. Co. Monarch (2 and 3 ply). Stowell's Slag.
Muscatine, Iowa, Huttig Mfg. Co., by Barber Asphalt Paving Co. Huttig Rubber (2 and 3 ply).
New York, Asphalt Ready Roofing Co., 136 Water Street. Arrow Brand Asphalt Ready Roofing (2 ply). Protection Brand Asphalt Ready Roofing. Stonehenge (2 ply).
New York, Barrett Mfg. Co., 17 Battery Place. Black Diamond (2 and 3 ply). Amatite. Amazon Ready (2 and 3 ply).
New York, The Eastern Granite Roofing Co., 19 Battery Place. Granite.
New York, H. W. Johns-Manville Co., 100 William Street. Standard Asbestos. Brooks Brand Asbestos (3 and 4 ply). J. M. Regal (2 and 3 ply).
New York, Standard Paint Co., 100 William Street. Ruberoid (2 and 3 ply).
New York, Warren Chemical and Manufacturing Co., 17 Battery Place. Rhinoceros (2 and 3 ply). Walrus (2 and 3 ply).
Philadelphia, The Barber Asphalt Paving Co. Genasco Smooth Surface (2 and 3 ply). Genasco Whitestone (2 ply). Genasco Stone. Genasco Model.
Philadelphia, The Buchanan-Foster Co., 504 West End Trust Bldg. Congo (2 and 3 ply).
Philadelphia, Warren-Ehret Co., 1202 Land Title Bldg. Ehrets (Slag).
San Francisco, Cal., The Paraffine Paint Co., Merchants' Exchange Bldg., Malthoid (2 and 3 ply).
South Bend, Ind., McHenry-Millhouse Mfg. Co. Climax Asphalt (2 and 3 ply). Veribest Rubber (2 and 3 ply).
St. Louis, Mo., Roofbestos Mfg. Co. Roofbestos (2 ply).
St. Paul, Minn., Union Roofing and Mfg. Co. Gal-va-nite.
Tonawanda, N. Y., National Roofing Co. Coarse Feldspar Security Wide-Weld. Crystalite. Diamond Grit. Fine Feldspar Security Wide-Weld. Liberty. Security. Security Wide-Weld Gravel Surfaced Roofing with Burlap Insertion. Sparkloid (2 and 3 ply). Standard.
Waukegan, Ill., The West Coast Company. West Coast Ready Rock.
York, Pa., Keystone Roofing Mfg. Co. X-L-Oid Rubber Roofing (2 and 3 ply).

SASH CHAIN. (See Hardware for Windows.)

SASH LOCK. (See Hardware for Windows.)

SHUTTERS. (See Doors and Shutters.)

SIGNAL AND FIRE ALARM SYSTEMS, BELLS FOR.

The following device has been examined and approved.

New York, Stanley & Patterson, 23 Murray St. Faraday (weather proof and skeleton type.)

SPRINKLERS, AUTOMATIC.

The following automatic sprinklers have been examined and tested under the rules and requirements of the National Board of Fire Underwriters and are approved for use:

Crowder, Issue A. Crowder Bros., 309 Merchants-Laclede Bldg., St. Louis, Mo.
Grinnell Improved 1903. General Fire Extinguisher Co., Providence, R. I.
International, Issue B. International Sprinkler Co., 123 William St., New York, N. Y.
Manufacturers, Issue C. Automatic Sprinkler Company of America, 123 William St., New York, N. Y.
Neracher Improved 1902. General Fire Extinguisher Co., Providence, R. I.
Niagara-Hibbard, Issue B. Automatic Sprinkler Company of America, 123 William St., New York, N. Y.
Rockwood, Issue C. Rockwood Sprinkler Co., 4 Arch Street, Worcester, Mass.

SPRINKLER SUPERVISORY DEVICES.

For use in connection with approved central station systems.

Consists of apparatus for transmitting signals when gate valves are closed or open; when water in tanks falls below or is restored to predetermined level; when pressure in air tanks falls below or is restored to predetermined amount; when water in tanks falls below or rises above predetermined temperatures. Also apparatus for connection with water flow valves to transmit water flow signals (where there is a flow of water equal to that of one or more sprinklers) and to withhold signals from water surges or variable pressures.

A. D. T. Devices for attaching to Central Station Signaling Systems for supervisory maintenance and operation of sprinkler equipments.

New York and Chicago. Automatic Fire Protection Company.

THERMOSTATS.

AUTOMATIC FIRE ALARMS.

These systems utilize the principle of the expansion under heat of air contained in a small copper tube which is installed along ceilings or piping. Tube leads to contact closing and test devices of special type. The expansion of air in tube actuates a diaphragm closing an electric circuit whereby signal is transmitted.

These devices as sold by the following companies are approved subject to the following conditions:

1. Underwriters having jurisdiction to be consulted in all cases before installations are made.
2. Tubing to be installed to comply as to location, distribution and spacing with requirements for thermostats of electric automatic fire alarms.
3. Central station equipments, local equipments, electric devices and circuits and other portions of this system other than the tubing and the pneumatic devices connected with it to comply in all respects with the requirements for similar portions of automatic fire alarm systems.
4. Labels. Tubing for these systems constructed according to approved specifications and examined and tested at factory under the supervision of Underwriters' Laboratories, Inc., bears tag reading: "Underwriters' Laboratories, Inspected Tubing for Automatic Fire Alarm, No. . . . . ." One such tag for each 100 feet of tubing installed should be preserved in transmitter case at risk as perma-

nent record of tubing used. Each Detector, Annunciator and Transmitter for this system constructed according to approved specifications and examined and tested at factory under supervision of Underwriters' Laboratories, Inc., bears metal label reading: "Underwriters' Laboratories, Inspected Automatic Fire Alarm Device, No. . . . . ."

Denver, Colorado. Frederick Thomas, Coronado Building, Agent for United States and Canada for English Patentees. "Aero."

New York. American District Telegraph Co., 195 Broadway. "Compensating."

VALVES, ALARM. (See also Sprinkler Supervisory Devices.)

No appliances meeting all of the requirements desirable for this service have as yet been shown.

Ratings covering the patterns found in common use have been issued as follows:

Evans Variable Pressure 1902 model. Manufactured by International Sprinkler Co., 517 Arch Street, Philadelphia. Not standard. Field experience limited, but fairly satisfactory where device has been properly installed, correctly adjusted and intelligently supervised.

Grinnell English Pattern, Variable Pressure (Swing check or Straightway type). Manufactured by General Fire Extinguisher Co., Providence, R. I. Not standard. Field experience fairly satisfactory where device has been properly installed, correctly adjusted and intelligently supervised.

Grinnell branch (old type called Harkness Tee). Manufactured by General Fire Extinguisher Co., Providence, R. I. Not standard. Field experience, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

Manufacturers. Manufactured by Manufacturers' Automatic Sprinkler Co., 1–11 Liberty Street, New York. Not standard. Field experience with an improved type of this valve in one locality, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

Niagara. Manufactured by Niagara Fire Extinguisher Co., Akron, O. Not standard. Field experience with an improved type of this valve in one locality, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

Rockwood Variable Pressure. Manufactured by Rockwood Sprinkler Company, Worcester, Mass. Not standard. Field experience limited, but fairly satisfactory where device has been properly installed and intelligently supervised.

Venturi. Manufactured by Venturi Alarm Co., Dover, N. J. Not standard. Field experience limited and not wholly satisfactory.

VALVES, DRY PIPE.

For use in connection with Automatic Sprinkler Equipments.

The following dry pipe valves have been examined and tested and are approved for use:

Grinnell Straightway, 4, 5 and 6-inch sizes. The General Fire Extinguisher Company, Providence, R. I.

International (No. 4 Evans Model), 4-inch and 6-inch sizes. International Sprinkler Co., 123 William St., New York, N.Y.

Manufacturers (Model 3), 4-inch and 6-inch sizes. Automatic Sprinkler Co. of America, 123 William St., New York, N. Y.

Niagara (1909 Model), 4-inch and 6-inch sizes. Automatic Sprinkler Company of America, 123 William St., New York, N.Y.

Rockwood, 4-inch and 6-inch sizes. Rockwood Sprinkler Co., Worcester, Mass.

Where these valves are used be sure that they are installed in accordance with the Rules and Requirements of the National Board of Fire Underwriters, copy of which may be obtained from your insurance agent.

WASTE CANS. (See Cans, Waste.)

WATCHMEN'S TIME RECORDING APPARATUS.

Users of the following Time Recording Apparatus should in all cases consult local Underwriters having jurisdiction concerning the particular type of appliance or system to be used, the number and location of stations, character and installation of wiring, methods to be followed in receipt and disposition of signals, keeping of records, rendering reports and all other details having a bearing on proper installation, maintenance and use.

The label is evidence of proper construction of the devices at the factories.

BOXES FOR CENTRAL STATION SYSTEMS.

Combined Watchmen's Call and Fire Alarm Boxes for use in connection with approved normally closed circuit Central Station Watchmen's Time Recording Apparatus, shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the rules of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by labels fixed to the outside of the clock cases reading:

The following companies are equipped to supply these devices:

Baltimore, Viaduct Electric Co., 10 S. Howard Street.
Milwaukee, Signalphone Company.
New York, American District Telegraph Co., 195 Broadway.
Washington, The Williams Company, Stewart Building.

APPARATUS FOR LOCAL OR PRIVATE SYSTEMS.

Watchmen's Time Recorders shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the rules of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by labels fixed to clock cases reading:

and a decalcomania transfer is applied to the outside of the clock station cases reading:

The following companies are equipped to supply these devices of the types listed below:

Boston, Eco Magneto Clock Co., 234-236 Congress Street. Stationary with magnetos, circular dial and cylindrical dial types. Portable.

Boston, E. Howard Clock Co., 373 Washington Street. Stationary with magnetos, circular dial and cylindrical dial types.

Brookline, Boston, Holtzer-Cabot Electric Co. Stationary with magnetos, circular dial.

Buffalo, The Jaynes Electrical Co., 806 Main St. Stationary with magnetos, circular dial.

Chicago, Chicago Watchman's Clock Works, 58-60 Wabash Avenue. Portable.

Chicago, Newman Clock Co., 1526 Wabash Avenue. Stationary, single station type. Portable.

Chicago, The Timekeeper Co., 1524 Wabash Avenue. Portable.

Chicago, Hardinge Bros., 3135 Lincoln Avenue. Portable, double dial and single dial types with plunger keys; single dial type with steel key.

Cleveland, American Watchman's Time Detector Co., E. 35th St. and Perkins Ave. Stationary with magnetos, circular dial types.

Gardner, Mass., Simplex Time Recorder Co. Stationary with magnetos, cylindrical dial type.

Grand Rapids, Mich., E. A. Hamilton & Co. Stationary with magnetos, circular dial type.

Jersey City, Manhattan Electrical Supply Co. Magnetos only, for stationary clocks.

New York, American Watchman's Time Detector Co., 234–5 Broadway. Stationary with magnetos, circular dial type.

New York, Edwards & Company, 140th and Exterior Sts. Stationary with magnetos, circular dial type.

New York, General Watchman's Time Detector Co., 27 Pine Street. Portable.

New York, E. O. Hausburg, 45 Maiden Lane. Stationary with magnetos, circular dial type. Portable.

New York, Nanz Clock Company, 178 Fulton Street. Portable.

New York, Standard Watchman's Time Detector Co. (W. Romaine), 1-3 West Broadway. Stationary with magnetos, circular dial type.

WINDOWS.

Window Frames for Wired Glass, shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., bear metal labels riveted in place, reading:

The label is evidence of proper construction of the appliance at the factory. Prospective users should first ascertain from the Underwriters having jurisdiction which type, if any, of wired glass windows will be accepted in the location desired, and should make contracts subject to approval by them of the installation, glazing and automatic attachments.

The following companies are equipped to supply these devices, which when properly installed and equipped are approved for protection against moderate exposures in openings not exceeding 5 feet by 9 feet.

Atlanta, Ga., Dowman-Dozier Mfg. Co., 605 Rhodes Bldg. Double Hung.

Baltimore, Md., The C. D. Pruden Co., Warner, Dock and Bayard Streets. Double Hung; Double Hung with Stationary Transom; Double Hung with Pivoted Transom; Stationary; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Boston, Mass., E. B. Badger & Sons Co., 63 Pitts Street. Double Hung; Twin Double Hung; Stationary (2 types); Twin Stationary; Top Hinged; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Pivoted Upper and Double Hung Lower Sash; Twin Pivoted Sash.

Boston, Mass., E. Van Noorden Co., 100 Magazine Street. Double Hung; Pivoted Upper Sash; Single Pivoted Sash.

Brooklyn, N. Y., Herrmann & Grace, 671–685 Bergen Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Buffalo, N. Y., Machwirth Bros. Company, 201–209 Oak Street. Pivoted Upper Sash; Pivoted Upper and Lower Sash.

Chicago, Ill., Grace Cornice Works, 1260 Indiana Avenue. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Chicago, Ill., Illinois Roofing & Cornice Co., 1144 West Kinzie Street. Double Hung; Twin Double Hung; Stationary; Twin Stationary; Top Hinged Sash; Twin Top Hinged Sash; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash; Three Pivoted Sash.

Chicago, Ill., Knisely Bros., Fifth Avenue and 28th Place. Double Hung; Stationary; Casement; Top Hinged; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Chicago, Ill., Harry C. Knisely Co., 506 So. Canal St. Double Hung; Twin Double Hung Sash; Stationary; Twin Stationary Sash; Top Hinged Sash; Top Hinged Upper and Stationary Lower Sash; Twin Hinged Sash; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash; Three Pivoted Sash; Pivoted Upper and Two Stationary Sash; Stationary Upper and Lower; Pivoted Middle Sash.

Chicago, Ill., J. C. McFarland & Co., 27th Street and Fifth Avenue. Double Hung; Stationary; Casement; Top Hinged Sash; Top Hinged Upper and Stationary Lower; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Chicago, Ill., James A. Miller & Bro., 114–116 So. Clinton Street. Double Hung; Stationary; Twin Stationary Sash; Top Hinged Sash; Twin Top Hinged Sash; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash.

Chicago, Ill., Perkinson & Brown, 413–415 N. Lincoln Street. Double Hung; Twin Double Hung Sash; Stationary; Twin Stationary; Top Hinged Sash; Twin Top Hinged Sash; Top Hinged Upper and Stationary Lower; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash.

Chicago, Ill., E. A. Rysdon & Co., 527 W. 41st Street. Double Hung; Stationary; Top Hinged; Top Hinged Upper, Stationary Lower; Pivoted Upper Sash; Pivoted Lower Sash; Upper and Lower Sash Pivoted and Middle Sash Stationary.

Chicago, Ill., Sykes Steel Roofing Co., 930 W. 19th Place. Double Hung; Twin Double Hung Sash; Stationary (two types); Top Hinged (two types); Twin Top Hinged Sash; Pivoted Upper Sash (two types); Pivoted Lower Sash (two types); Pivoted Upper and Lower Sash (two types); Single Pivoted Sash (two types); Twin Pivoted Upper Sash.

Chicago, Ill., Voigtmann & Co., 445–459 W. Erie Street. Double Hung (two types); Stationary; Twin Stationary Sash; Casement; Top Hinged Sash; Top Hinged Upper and Stationary Lower Sash; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash; Three Pivoted Sash; Pivoted Middle and Stationary Upper and Lower.

Chicago, Ill., W. D. Watson Co., 1037 W. Van Buren Street. Stationary; Top Hinged; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Cincinnati, Ohio, The Edwards Mfg. Co., Eggleston Avenue, 4th and 5th Streets. Double Hung; Pivoted Upper Sash.

Cincinnati, Ohio, Jacob Freund Roofing Co., B. & O. S. W. Ry., near Mitchell Avenue. Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Cincinnati, Ohio, Thomas Lee, 128 W. Second Street. Double Hung; Stationary; Top Hinged Sash; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Cincinnati, Ohio, Witt & Brown, 215 West 3d Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Cleveland, Ohio, Ohio Roofing Co., 1477 Euclid Avenue. Double Hung.

Cleveland, Ohio, Riester & Thesmacher Co., 1514-1526 W. 25th Street. Double Hung (two types); Counterbalanced; Stationary; Pivoted Upper Sash (two types); Pivoted Lower Sash; Single Pivoted Sash.

Cleveland, Ohio, The Rudolph & Son Co., 416-420 Prospect Ave., N. W. Double Hung; Pivoted Upper Sash.

Columbus, Ohio, F. O. Schoedinger, 146-148 North 3d St. Double Hung (two types).

Detroit, Mich., W. J. Burton Co., 164-166 West Larned Street. Double Hung; Pivoted Upper Sash.

Galveston, Texas, Texas Sheet Metal Works, 2624-2626 Mechanic Street. Double Hung.

Hoboken, N. J., Leonard Sheet Metal Works, 215-221 Grand Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Kansas City, Mo., Monarch Metal Mfg. Co., 1722 Tracy Avenue. Double Hung; Twin Double Hung; Stationary; Twin Stationary; Top Hinged; Twin Top Hinged; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash.

Kansas City, Mo., J. A. Ritzler Cornice & Ornament Co. Double Hung; Pivoted Upper Sash.

Kansas City, Mo., Henry Weis Cornice Co., 1811-1815 Wyandotte Street. Double Hung; Twin Double Hung Sash; Counterbalanced; Stationary; Twin Stationary; Top Hinged Sash; Pivoted Upper Sash (two types); Pivoted Lower Sash; Pivoted Upper and Lower Sash (two types); Single Pivoted Sash (two types); Twin Pivoted Sash.

Kansas City, Mo., Zahner Mfg. Co., 310-316 West 20th Street. Double Hung (two types); Top Hinged Sash; Stationary (two types); Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Lebanon, Pa., C. Bressler & Co. Double Hung.

Los Angeles, Cal., California Cornice Works, 1610-1614 San Fernando Street. Double Hung.

Louisville, Ky., J. F. Wagner & Sons, 1145-1149 Seventh Street. Double Hung; Stationary; Twin Stationary; Top Hinged; Hinged Upper and Fixed Lower; Fixed Upper and Top Hinged Lower; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Milwaukee, Wis., Biersach & Niedermeyer Co., 216-220 Fifth Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Milwaukee, Wis., Consolidated Sheet Steel Metal Works, 661 Hubbard Street. Double Hung; Twin Double Hung Sash; Stationary; Hinged Sash; Twin Hinged Sash; Hinged Upper and Stationary Lower Sash; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash; Single Pivoted Basement Sash; Pivoted Upper Basement Sash; Three Pivoted Sash; Pivoted Upper and Lower, Stationary Middle Sash; Pivoted Middle, Stationary Upper and Lower Sash; Pivoted Lower, Stationary Upper and Middle Sash; Pivoted Upper, Double Hung Lower Sash; Pivoted Upper, Stationary Middle and Lower Sash; Special Mullion Windows.

Minneapolis, Minn., Crittenden Roofing & Mfg. Co., 1121-23 Seventh St., So. Double Hung; Stationary (single sash).

Minneapolis, Minn., Northwestern Roofing, Cornice & Stamping Works, 1113 Fifth St. Double Hung.

Minneapolis, Minn., Selden Roofing & Mfg. Co., 76 Western Avenue. Double Hung.

Minneapolis, Minn., Stremel Bros. Roofing and Cornice Co., 1215–1219 Washington Avenue, N. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Newark, N. J., Essex Cornice and Skylight Works, 107–111 Houston Street. Stationary. Pivoted Upper Sash; Pivoted Lower Sash; Single Pivoted Sash; Double and Triple Pivoted Sash.

New Orleans, La., American Sheet Metal Works, Carrollton Avenue and Edinburgh Street. Double Hung (two types); Stationary (two types); Twin Stationary Sash (two types); Pivoted Upper Sash (two types); Pivoted Upper and Lower Sash (two types); Single Pivoted Sash (two types); Twin Pivoted Sash (two types); Triple Pivoted Sash; Fixed Upper and Pivoted Lower Sash.

New Orleans, La., Estate of R. G. Holzer, 317–323 Burgundy Street. Double Hung Sash; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

New Orleans, La., A. J. Nelson Mfg. Co. Double Hung; Stationary; Top Hinged Sash; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

New Orleans, La., New Orleans Roofing and Metal Works. Double Hung.

New York, N. Y., J. F. Blanchard Co., Fuller Building, Broadway and 23d Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

New York, N. Y., The Geo. Hayes Co., 71 Eighth Avenue. Pivoted Upper Sash.

New York, N. Y., S. H. Pomeroy Co., Inc., 427 W. 13th Street. Double Hung (two types); Twin Double Hung; Stationary; Twin Stationary Sash; Counterbalanced Sash; Casement; Top Hinged Sash; Top Hinged Upper and Stationary Lower; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash; Three Pivoted Sash; Two Pivoted and Stationary Lower Sash; Special Mullion Windows.

New York, N. Y., M. F. Westergren, Inc., 213–221 E. 144th Street. Double Hung; Pivoted Upper Sash (two types); Pivoted Upper and Lower Sash.

Philadelphia, Pa., David Lupton's Sons Co., Allegheny Avenue and Tulip Street. Double Hung; Twin Double Hung Sash; Stationary Sash; Casement; Top Hinged Sash Opening in; Top Hinged Sash Opening out; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash.

Philadelphia, Pa., Lyster Sheet Metal Co., 1218–1220 Filbert St. Double Hung.

Philadelphia, Pa., The J. S. Thorn Co., 20th and Allegheny Avenue. Double Hung (two types); Counterbalanced Sash; Stationary Sash; Casement; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Pittsburg, Pa., Allegheny Cornice & Skylight Co., 821 Boquet Street, N. S. Double Hung; Twin Double Hung Sash.

Pittsburg, Pa., Thos. W. Irwin Mfg. Co., 401-411 Rebecca Street, N. S. Double Hung; Pivoted Upper Sash.

Pittsburg, Pa., Keighley Metal Ceiling & Mfg. Co. Double Hung; Stationary Sash; Top Hinged; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Three Pivoted Sash.

Pittsburg, Pa., Rasner & Dinger Co., Second Ave. and Ferry St. Double Hung; Pivoted Upper Sash.

Portland, Ore., Portland Sheet Metal Works, 429 E. Madison Street. Double Hung Sash.

Saginaw, Mich., Saginaw Sheet Metal Works. Stationary (single sash); Stationary (double sash); Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Salem, O., W. H. Mullins Co. Double Hung (two types); Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Three Pivoted Sash.

San Antonio, Tex., T. P. Walsh. Double Hung.

San Francisco, Cal., Forderer Cornice Works, corner Potrero Avenue and 16th Street. Double Hung (two types); Stationary; Pivoted Upper Sash (two types); Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

San Francisco, Cal., The Rulofson Metal Window Works, 315–319 Monadnock Building. Double Hung; Pivoted Upper Sash.

San Francisco, Cal., San Francisco Cornice Co., Bryant between 9th and 10th Streets. Double Hung; Pivoted Upper Sash; Single Pivoted; Double Pivoted; Special Mullion Windows.

Seattle, Wash., Puget Sound Sheet Metal Works, Railroad Avenue, Wall and Elliott Streets. Double Hung Sash.

St. Louis, Mo., Eagle Metal Works, 1510–1512 Clark Avenue. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Pivoted Upper and Double Hung Lower Sash; Single Pivoted Sash.
St. Louis, Mo., Hopmann Cornice Co., 2571–2573 Benton Street. Double Hung.
St. Louis, Mo., Mesker & Bro., 421–519 So. Sixth Street. Double Hung; Double Hung Lower Sash with Stationary Transom; Double Hung Lower Sash with Hinged Transom; Double Hung Lower Sash with Pivoted Transom; Stationary; Top Hinged; Casement; Casement Sash with Stationary Transom; Casement Sash with Hinged Transom; Casement Sash with Pivoted Transom; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Vertical Pivoted Sash.
St. Louis, Mo., Powers & Boyd Cornice and Roofing Co., 3614–3616 Laclede Avenue. Double Hung; Stationary; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.
St. Louis, Mo., John F. Ruth Cornice Works, 4298 Page Avenue. Double Hung; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.
St. Louis, Mo., Von Der Au & Cluss Mfg. Co., 2404–2408 South Jefferson Avenue. Double Hung.
St. Paul, Minn., St. Paul Roofing and Cornice Co. Double Hung.
Toronto, Ont., Douglas Bros., Ltd., 128 Adelaide Street N. Double Hung.
Waterbury, Conn., Henry Weyand Co., Inc., 16–24 Jefferson Street. Double Hung.

WINDOW HARDWARE (See Hardware for Windows.)

WIRED GLASS.

One-quarter inch wired glass manufactured by the following companies is approved for protection against moderate exposures, when used in sizes not exceeding 720 square inches and with neither dimension in excess of 48 inches, and provided with distinctive marking as noted.

Wired glass protection is not the equivalent to that furnished by approved fire doors and shutters except for moderate exposure. Notice is called to the need of using approved frames and sash and glazing and to the necessity for careful inspection before acceptance, in order to obtain wired glass of the required thickness.

New York, N. Y. Mississippi Wire Glass Co.
Marking: No distinctive marking. This manufacturer claims exclusive right to use of hexagonal mesh, but this form of mesh is being freely used by other manufacturers and sub-standard wired glass with hexagonal mesh is on the market.

Philadelphia, Pa. Pennsylvania Wire Glass Co.
Marking: Consists of a strand of the wire mesh made by twisting two No. 27 gage wires together, and spacing such distinctive cabled strand approximately 10 inches apart in each sheet of glass manufactured.

Streator, Ill. Western Glass Co.
Marking: Consists of five loops at each vertical strand of wire mesh.

Washington, Pa. Highland Glass Co.
Marking: Consists of a double strand of wire at intervals of 9½ inches. The two wires of the double strand are not twisted together except at the twisted portions of the mesh.

FOR USE IN CONNECTION WITH BURGLAR ALARM EQUIPMENTS.

Wired glass designed for use in connection with burglar alarm equipments.

One-fourth inch wired glass with series of parallel wires about ½-inch apart, approximately midway between surfaces. Submitted as possessing some value as a fire retardant.

When mounted in standard window frames with lights not in excess of 48 inches, this glass is approximately 50 per cent as efficient as standard wired glass for protection against moderate exposure.

The following company manufactures this material:

New York, N. Y. Mississippi Wire Glass Co., for American District Telegraph Co., 195 Broadway.